1129

Su-25 Frogfoot

in action

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Aircraft Number 129

On 6 February 1991, two Iraqi Air Force Su-25K Frogfoot As, in company with a pair of MiG-21 Fishbeds attempted to reach neutral Iran. They were intercepted by F-15Cs of the 53rd Tactical Fighter Squadron/33rd Tactical Fighter Wing and 1LT Robert Hehemann shot down both Su-25s with AIM-9 Sidewinder AAMs. Other Iraqi Su-25s were more lucky and a total of seven reached Iran, where they were impressed into the Islamic Republic of Iran Air Force.

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Sukhoi OKB

Dedication

This book is dedicated to my good friends, especially those who survived my 30th birthday party on 27 February 1992. As long you have good friends and a couple of beers it helps you face your troubles and the rebuffs of a girl. So without all of you, I would have more money in the bank, a better reputation in my hometown and would have woke up in the morning without this terrible hangover!

The Su-25 Frogfoot was the only Soviet aircraft truly feared by Afghan rebels. This Frogfoot A, Red 06 is actually a T-8 preproduction aircraft. It was in combat in Afghanistan before being reassigned to the 368th ShAP at Demmin-Tutow in the former German Democratic Republic. (Jens Schymura)

06

Introduction

The Sukhoi Su-25, a high maneuverable, heavily armed, ground attack aircraft, was one of the most potent weapons to come out of the Afghanistan war. It was not only the sheer volume of fire which could be delivered on a target that made the Su-25 so deadly, it was also the high degree of accuracy with which it could be delivered.

During the late 1960s, Pavel O. Sukhoi and his design staff started work on the first drawings for a jet powered *Shturmovik* as a totally private venture. Sukhoi proposed that it should build a jet powered, heavily armored ground attack aircraft, in the tradition of the Il-2 *Shturmovik*. This proposal was unusual in that it broke with traditional Soviet procurement procedures. Normally, a requirement for a new aircraft was submitted by the Ministry of Defense and the VVS (*Voenno Vozdushnye Sili*, Air Forces) to the MAP (*Ministerstvo Aviatsionnoi Promyshlennostil*, Ministry for Aircraft Production) and then to the different aircraft design bureaus/manufacturers within the Soviet Union.

The Soviets generally believed that future wars would be fought with high speed fighters and short range tactical missiles that would make a *Shturmovik* type aircraft totally obsolete. The Vietnam War, however, brought about a change in Soviet thinking. The Americans had excellent fighters which could deal with the MiG-17, MiG-19 and MiG-21 in air-to-air combat. The problem was in using these same high speed jets to answer quick reaction requests for close air support (CAS). Enemy activity tended to involve highly mobile and often hard to identify targets that were close to friendly troops and needed to be hit now.

The Americans learned this lesson and the USAF reintroduced the CAS concept and issued a requirement for an AX, Attack Experimental, aircraft during September of 1966. This program led to the Northrop YA-9A and the Fairchild-Republic YA-10A some six years later.

The Americans were not the only ones to study the lessons of the Vietnam War. The Soviet Union was also eager to obtain new information although, even with this information, Soviet doctrine was slow to change. High ranking officers and politicians did not grasp the value of a modern CAS aircraft, but this need was recognized by Pavel O. Sukhoi and his design team.

T-8 Prototypes

In 1971, a team under Jury V. Ivashezkin began work, without any official requirement, on the initial design sketches for a ground attack aircraft that would meet five basic requirements: carry a large weapons load, be equipped with adequate navigation and fire control systems, have armor protection for important aircraft systems and the cockpit, operate from unprepared strips and be easily maintained even under austere conditions.

Within a year Ivashezkin's team had completed the general layout and their proposal was submitted to the Ministry of Aircraft Production and the Soviet Air Force. Initially, it generated little interest, but the Sukhoi design team did not give up and their persistence finally paid off. The program eventually won the support of GEN A. N. Yefimov, assistant commander of the Soviet Air Force and a former Il-2 pilot, who won the backing of General of the Army I.G. Pavlovsky, Soviet ground forces commander.

Finally the project received official acceptance and Sukhoi began work on a prototype under the company designation T-8. The design team consisted of J.V. Ivanshezkin, O.S. Samoiloviz, D.N. Gorbazyevu and W.M. Lyebyedyev, under the leadership of

The T-8-1 prototype, Yellow 81, carried no underwing pylons and had the cannon mounted in a gondola under the starboard side of the nose. The wing had two wing fences, with the larger fence being outboard on the wing. (Sukhoi OKB)

Sukhoi chief designer, Vladimir P. Babak. As was traditional in Soviet aircraft development there was a close working relationship between Sukhoi and the TsAGI (*Tsentral'ny Aerogidrodinamicheski Institut*, Central Aero and Hydrodynamics Institute) at Zhukovski. A number of different designs were evaluated and tested in the TsAGI wind tunnel. TsAGI also made several wing shape proposals and several wing sweep angles were evaluated before the best configuration was determined.

Sukhoi also worked in close cooperation with the air force to determine the service's needs regarding weapons load, mission profile and maintenance requirements. All of this information went into a tactical-technical requirement that was officially issued to the OKB in 1973. Additionally, the air force also gave the same tactical/technical requirement to Ilyushin who began work on a new design based on their earlier Il-40 ground attack aircraft.

The Ilyushin prototype, given the company designation Il-102, emerged as a twin engine, two place, swept wing aircraft with a gross weight of 48,500 pounds with a payload of some 15,873 pounds. It was powered by two 11,400 lbst RD-33I turbojets giving it a maximum speed of 590 mph. The swept wing held three internal bomb bays and three underwing pylons capable of carrying a wide variety of weapons. A gunner in the rear cockpit controlled a twin barrelled cannon in the tail. The prototype made its first flight during 1978, but during tests against the Sukhoi design, it was found to be inferior in almost all respects and was abandoned.

The first Sukhoi prototype, which was built at the Sukhoi experimental shop near Moscow, was given the designation T-8-1 and was powered by two non-afterburning RD-9 engines. Carrying the tactical number Yellow 81, the prototype rolled out armed with a

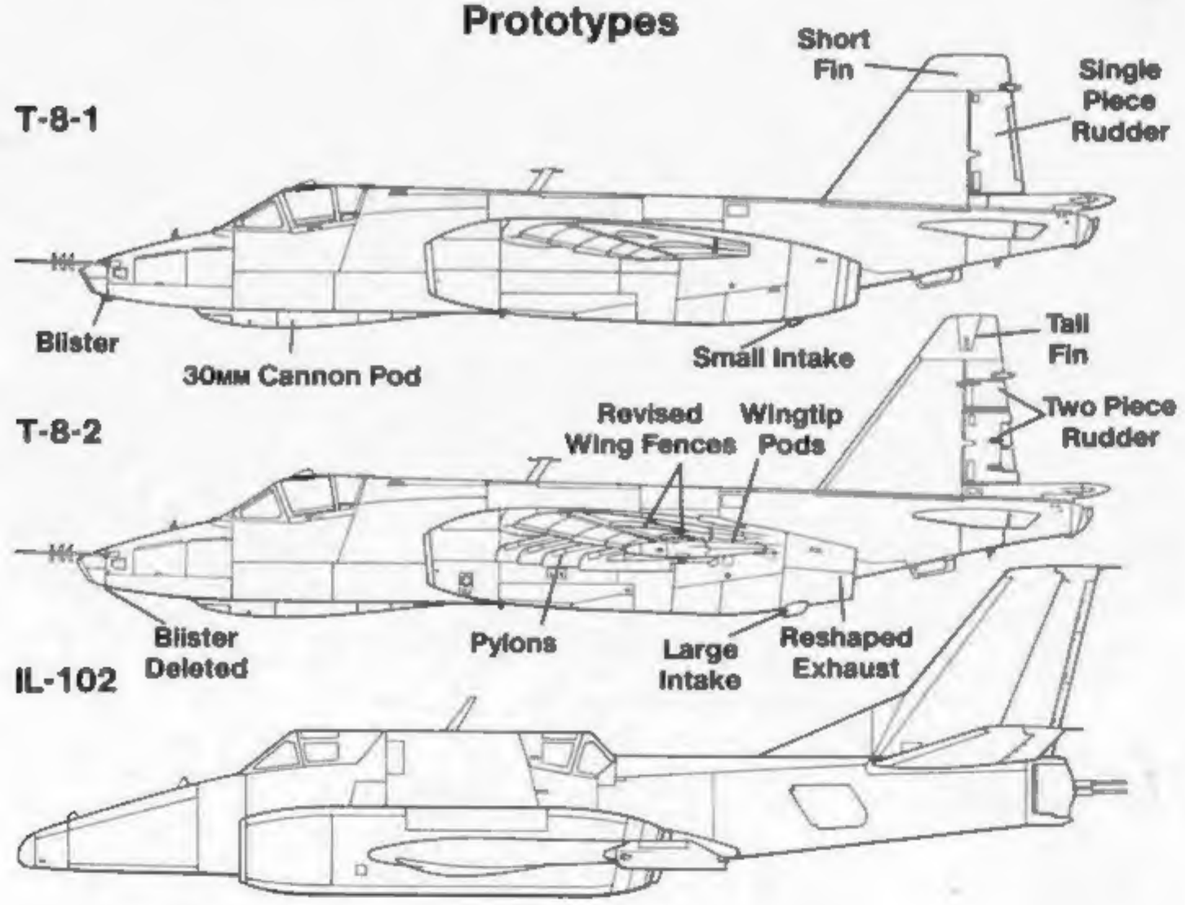
The IL-102 was a competitor to the T-8 Frogfoot and featured a two man crew, internal weapons bays in the wing, external weapons pylons and a twin barrelled 23мм cannon in the tail. The aircraft was found to be inferior to the T-8 and the project was cancelled. (Harry Wisch)

twin barrelled AO-17A 30MM cannon mounted in a gondola under the starboard side of the nose. After initial check out, it was transported to the Zhukovski Flight Center (known in the west as Ramenskoye). The T-8-1 prototype flew for the first time on 22 February 1975 with General Major Vladimir V. Ilyushin, son of the famous designer Sergej V. Ilyushin, at the controls.

The T-8-1 was soon followed by a second prototype, the T-8-2 (coded Yellow 82). The second prototype differed from the first in that it featured wingtip mounted pods which contained avionics. The rear half of each pod was split to act as speed brakes. The wing fences were changed with the larger wing fence being inboard on the T-8-2. The second prototype carried four underwing pylons plus a smaller fifth pylon capable of carrying a K-13 (AA-2) air-to-air missile for self defense. The fin and rudder of the second prototype were enlarged and the single piece rudder of the T-8-1 was replaced by a two piece rudder. The nose was recontoured slightly, the small blister fairing on the underside of the nose on the T-8-1 was deleted and the exhaust was recontoured.

Both prototypes passed the factory test trials and were passed to the LII (*Lyotno-Issledovatel'ski Institut*, Flight Research Institute) for State Acceptance trials. At this point, the Minister of Aviation Production, P.V. Dementyev, refused to authorize production of the aircraft with the RD-9 power plant, since it was no longer in production. As a result, it was suggested that the aircraft be powered by a non-afterburning version of the Tumansky R-13-300.

The two prototypes were re-engined with non-afterburning R-13-300 power plants which resulted in a recontoured, thinner exhaust nozzle and the deletion of the air intake on the rear portion of the engine nacelle. In 1977, the Sukhoi OKB decided to make a number of modifications to the T-8, resulting in a decision to produce a third prototype, designated the T-8-3 and coded Yellow 83 (both original prototypes were also modified to the new configuration).



Compared with the original T-8-1, some 148 changes were made to the T-8-3. The R-13-300 power plants were replaced with R-95Sh engines (a modified R-13-300 capable of burning a wide variety of fuels). One drawback was that when the non-standard fuels were used, engine operation was limited to four hours.

Another change centered around the gun armament. The 30MM cannon was moved from the gondola under the starboard side of the nose to an internal mounting under the port side of the forward fuselage.

The T-8-3 prototype never flew, it was taken to the NII-VVS (*Nauchno Issledovatel'skii Institut-Voenno Vozdushnye Sili*, Scientific Research Institute of the Air Force) for airframe survivability test involving a number of different weapons, including shoulder-launched missiles.

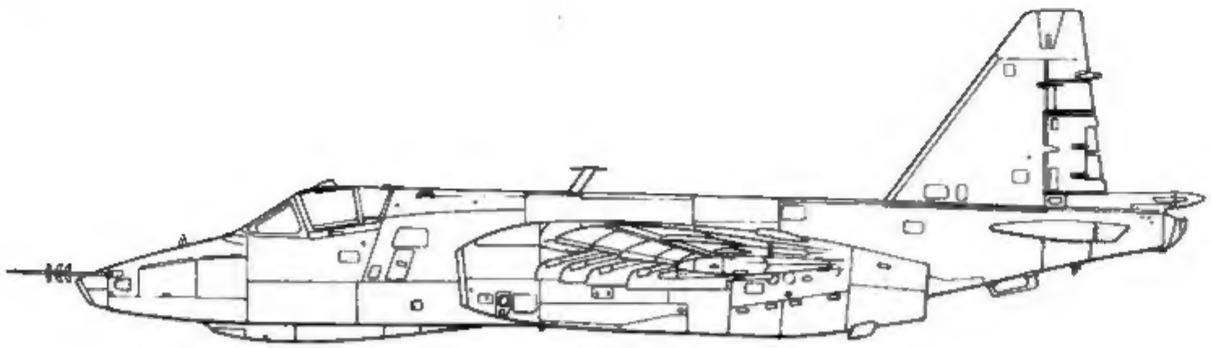
During 1977, some two years after its maiden flight, the T-8 was detected by American reconnaissance satellites and given the designation RAM-J (RAM for Ramenskoye). Later, the ASCC-Reporting Name Frogfoot was assigned to the T-8, although the allocation of the name caused some controversy within the ASCC. The Su-25 was far from being a dedicated fighter and many felt it should have had a bomber name.

The T-8-1 and T-8-2 rejoined the flight test program during 1978 and both passed the factory and State Acceptance tests. Then both aircraft were passed to the NII-VVS for weapons trials and field deployment tests. Again, both passed all the required tests. As a result, Sukhoi was authorized to begin production of a number of T-8 preproduction aircraft at the Sukhoi facility in the Georgian capital of Tbilisi.

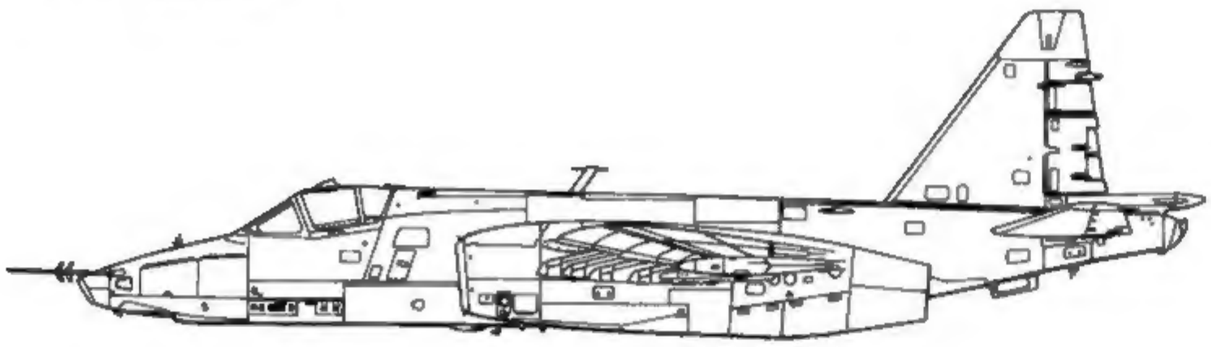
By 1980, the Soviets had come to realize that the Afghanistan war was not going to be over quickly. Close air support (CAS) missions flown by Su-17M, MiG-21MF and Mi-24s revealed that none of these types was really suited for this role. As the result, the two T-8 prototypes were flown to Kabul in April of 1980, replacing a number of Navy Yak-38 Forgers which had proved to be totally unsuited to the CAS role. The two T-8 prototypes remained in Afghanistan and subsequently joined the 200th Guards Squadron at Shindand. Western Intelligence received a photograph of the T-8-2 when the aircraft was photographed during a raid on a rebel strong point.

The second prototype, T-8-2, Yellow 82, differed from the first prototype in that the wing fences were revised with the larger fence now being inboard. The aircraft carried four large weapons pylons and a fifth smaller pylon for an AA-2 air-to-air missile. The fin was enlarged and the rudder was altered. The wing tip pods held avionics and the rear halves acted as speed brakes. (Sukhoi OKB)

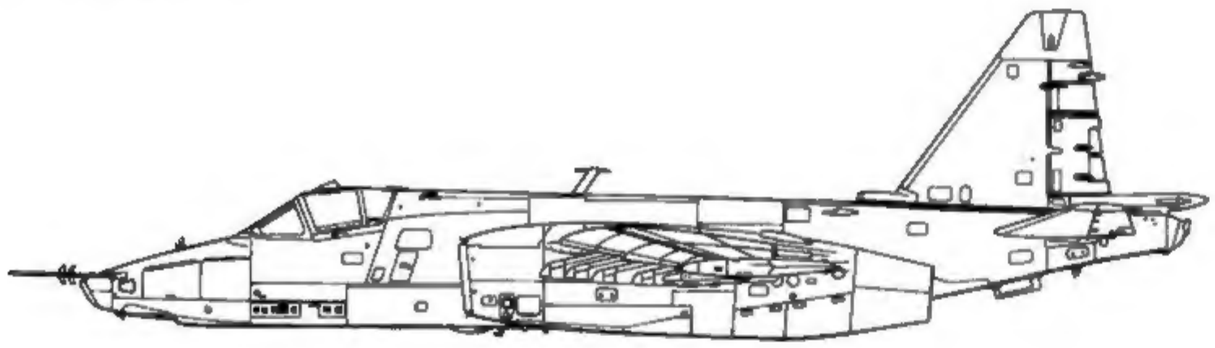
Development



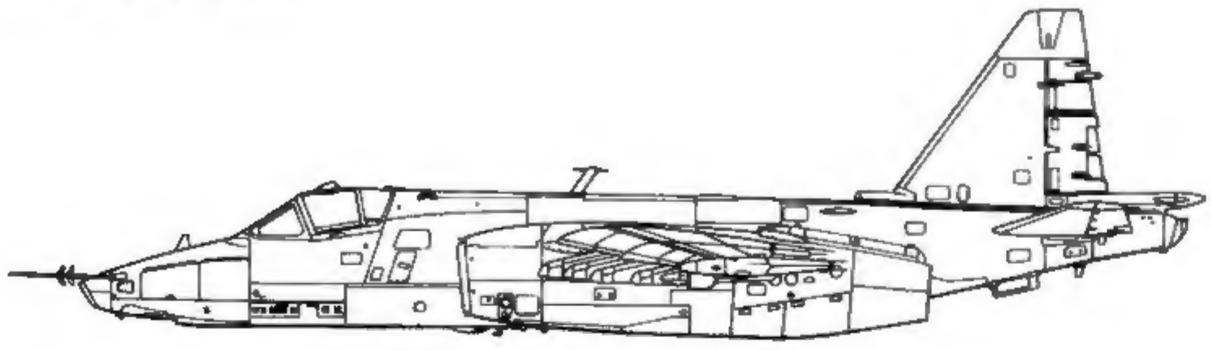
T-8-2 Prototype



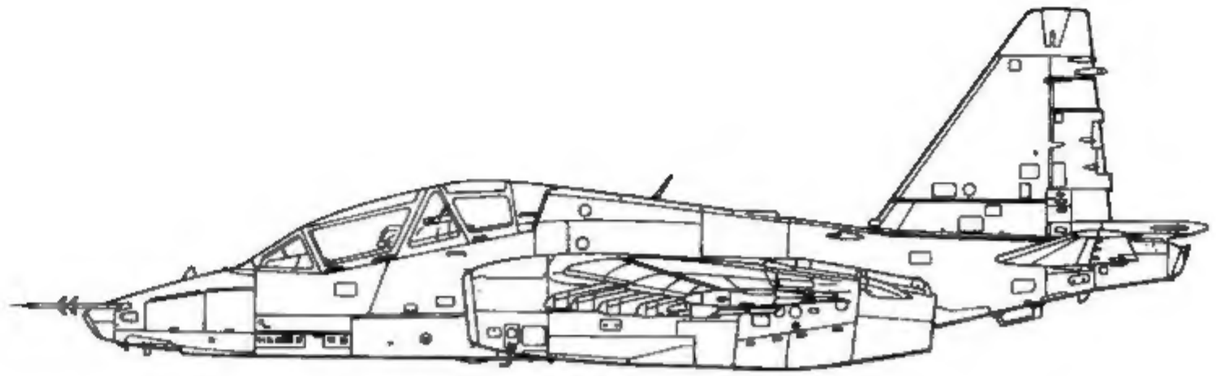
T-8 Frogfoot A



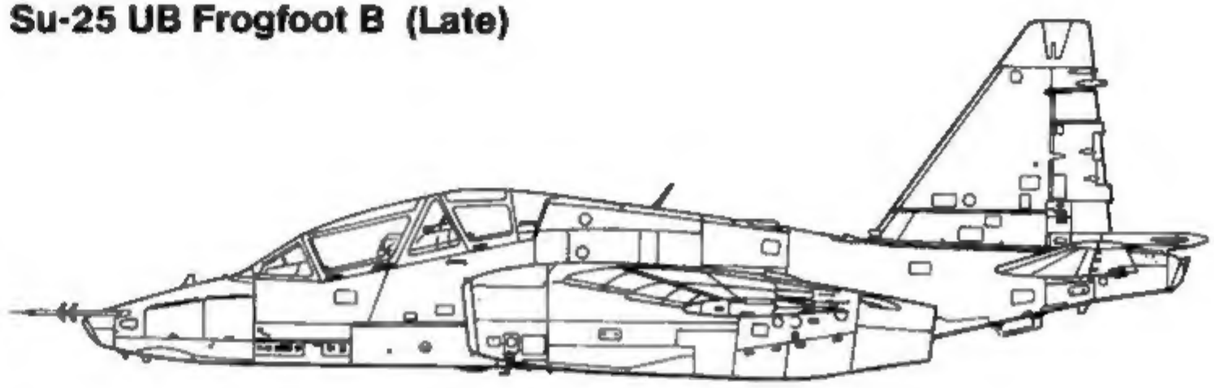
Su-25 Frogfoot A



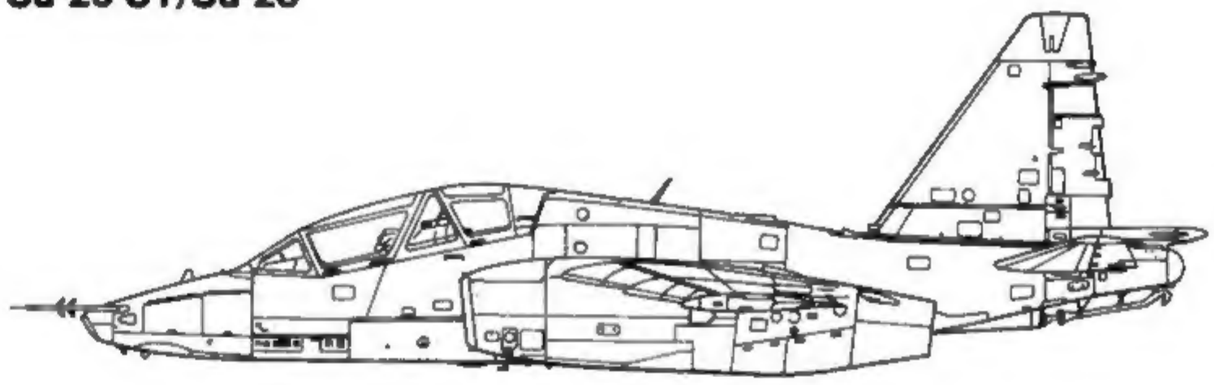
Su-25 Frogfoot (Late)



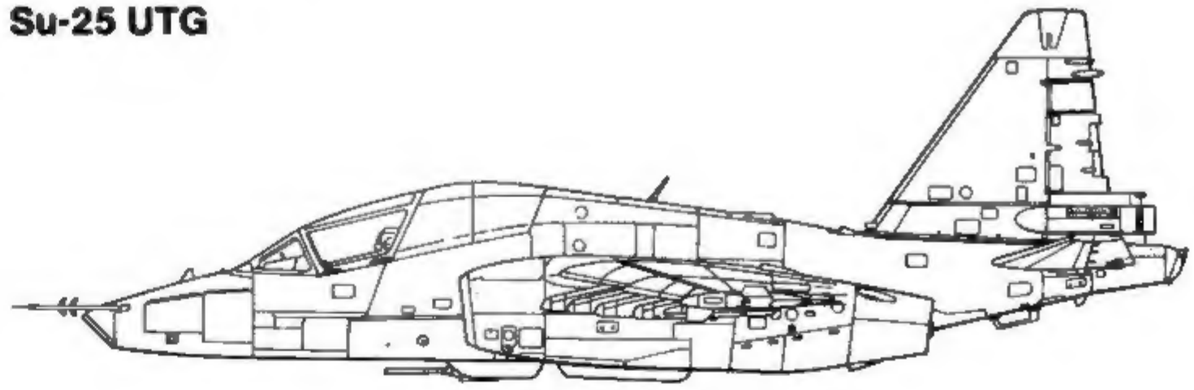
Su-25 UB Frogfoot B (Late)



Su-25 UT/Su-28



Su-25 UTG



Su-25 TM/TK

T-8 Preproduction Frogfoot A

Once the T-8 prototypes had successfully passed the state acceptance trials, Sukhoi was authorized to construct a number of preproduction aircraft at the Sukhoi facility at Tbilisi, Georgia (Georgia became an independent republic in December of 1991).

The modification program undertaken with the T-8-3 during 1977, although highly successful, had delayed the entire program by some three years and had also increased the unit cost of the aircraft. According to Soviet sources, the unit price for a Frogfoot A was some 5.8 million Rubles.

There were a number of differences between the original T-8 prototypes and the T-8 preproduction aircraft, although most of these changes were internal. Externally, the engine air intake was enlarged and a ram air intake was installed on the top and bottom of the starboard engine nacelle. The cooling air intakes on the lower engine nacelles of the prototypes were deleted on the preproduction aircraft, as were the two wing air flow fences. The angle of the horizontal stabilizer was changed from anhedral (negative angle) to dihedral (positive angle).

The underwing pylons were reduced in size and more tapered in shape when compared to the pylons used on the T-8-2 prototype and there was a small air intake in front of the canopy on the T-8-2 prototype which was deleted. The preproduction Frogfoot featured air data probes on both sides of the nose and an angle of attack vane. The nose of the T-8-2 prototype was flatter with a square window for the laser target designator, while the preproduction Frogfoot A was fitted with a more rectangular laser window. The nosewheel door on the T-8-2 was rectangular, while the preproduction aircraft had a more triangular shaped door. The gun installation was the same as on the T-8-3 prototype.

The Frogfoot A was equipped with a number of features dedicated to increasing the protection for the pilot and vital aircraft components. The cockpit was effectively a box of welded 24MM (0.94 inch) titanium armor capable of withstanding up to fifty hits from 20MM or 23MM rounds, while additional armor was installed above the K-36L ejection seat. The K-36L ejection seat is a zero-zero seat developed by a team under Utkin Syevyerin during 1964. The seat has a weight of some 507 pounds, nearly twice the weight of Western ejection seats. The seat is very reliable, with a record of 97 out of 100 actual ejections where the pilots suffered no injuries during the ejection sequence.

Armor protection is also provided for the engine oil tank (housed in the starboard engine nacelle) and the fuel lines leading from the armored main tank to the engines. The titanium control surface push rods are 40MM in diameter and are capable of withstanding hits up to 12.7MM (.50 caliber). The elevator controls have dual control rods for additional safety. All fuel tanks were filled with a plastic foam designed to prevent a hit from causing an explosion in the tank. The fuel lines are located in such a manner that they cannot spray fuel into the engine if they are damaged.

Electrical power is supplied by two independent electrical systems, each with its own DC generator, battery and AC generator. These components are located in such a way that they cannot be destroyed by a single hit. There are also two independent engine driven hydraulic systems which operate the landing gear, the speed brakes and stabilizers. Additionally, the preproduction Frogfoot A carried a radar warning receiver antenna on the vertical fin above the rear position light.

When the first preproduction T-8, coded Blue 84, left the Sukhoi plant it carried the crest of the city of Tbilisi on the nose. The third T-8 preproduction aircraft, Blue 86, was assigned to a demonstration unit at Kubinka Air Force Base near Moscow for demonstrations to potential export customers. During one such demonstration on 4 July 1990, MAJ Sergej Kirillov, one of the most experienced pilots at Kubinka, crashed during a low level maneuver and was killed. The Frogfoot A, Blue 86, was totally destroyed.

One of the most widely known Frogfoot As was T-8-15, Blue 15, which saw considerable combat service in Afghanistan. This preproduction Frogfoot A was sent to Afghanistan and based at Shindand where it was flown by COL Alexandr V. Rutskoi, who later became the most highly decorated Frogfoot pilot in the Afghanistan War. During 1988 his aircraft, Blue 15, was damaged by ground fire, but he was able to get the aircraft back to base. After repairs, Blue 15 was once again assigned to COL Rutskoi, only to be severely damaged again during a cross-border raid into Pakistan. This time, the aircraft was hit by two AIM-9L Sidewinders fired by intercepting Pakistani F-16s. Although hit, Rutshoi was able to safely return to Afghanistan with the severely damaged Frogfoot!

Rutskoi's luck ran out on another cross border raid into Pakistan on 4 August 1988. COL Rutskoi was leading a four ship *Zveno* (Flight) of T-8s when the formation was intercepted by Pakistani F-16s from Kamra Air Force base. An AIM-9L launched from Squadron Leader Ather's F-16 hit Rutskoi's Frogfoot A and he was forced to eject near the town of Miran Shah some fourteen miles inside the Pakistani border. He was released to Soviet authorities some two weeks later and the remains of the Frogfoot were put on display at Kamra Air Force Base.

Rutskoi's original aircraft, Blue 15, was sent back to the Soviet Union and overhauled at Tbilisi. It was used to conduct tests with electronic pods fitted on the wing tips, which were later removed. This same aircraft participated in the 38th Aero Salon at Paris held between 8 and 18 June 1989. Freshly repainted and fitted with English maintenance instructions, the aircraft was also modified with special electronics to allow it to operate on western airways. The Frogfoot carried the Paris Aero Salon participant number 301 on the nose in Dark Blue. The 1989 Paris show marked the first public appearance of a Frogfoot in the West.

The T-8-4, Blue 84, was the first preproduction Frogfoot A built at Tbilisi and carried the crest of the Georgian capital on the nose in front of the tactical number. The aircraft is armed with B-8M1 twenty shot rocket pods, OFAB-250 551 pound fragmentation/demolition bombs and carries PTB-1150 drop tanks on the inboard pylons. (Yefim Gordon)

When the aircraft returned from Paris it was modified for weapon trials and once completed, the aircraft was donated by Sukhoi to the aviation museum at Khodinka during the Summer of 1991. The aircraft was exhibited with the number Blue 301 and Alexander Rutskoi's name on the fuselage. MGEN Rutskoi, now Vice-President of the Russian Republic, was responsible for the defense of the Russian parliament building during the ill-fated coup attempt on 19 August 1991.

Most T-8 preproduction aircraft were deployed to Afghanistan for combat operations once reports were received in Moscow about the superior performance of the two prototypes (T-8-1 and T-8-2) in combat. By late 1980, a full squadron of twelve Frogfoot As had been dispatched to the 200th Guards Attack Squadron at Shindand. They began flying operations immediately and were transferred to Kabul during 1982. At Kabul the T-8 received the nickname *Grach*, which is a kind of Russian crow, also called a rook. The nickname was given to the aircraft by Soviet ground troops. The outstanding support given to the troops by the Frogfoot caused them to liken the aircraft to a rook, which covers its children with its wings in times of danger. Some T-8s and later production Su-25s which took part in the Afghanistan war had a cartoon *Grach* painted on the fuselage.

MAJ Sergej Kirillov in front of a preproduction Frogfoot A T-8-8, Blue 86, prior to a demonstration flight. This very experienced pilot was killed flying this aircraft during a demonstration flight at Kubinka on 4 July 1990. (Yefim Gordon)

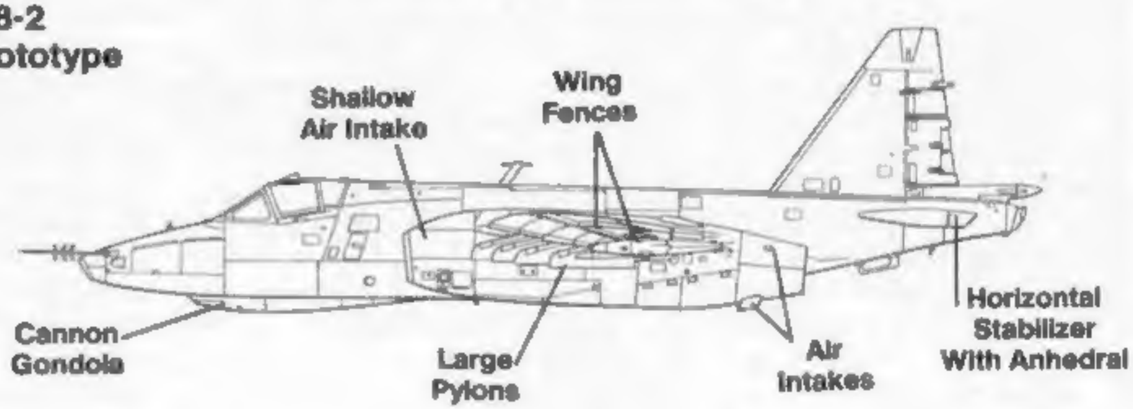
The Frogfoot proved to be the most effective Soviet weapon used in the Afghanistan conflict. With its outstanding maneuverability the Frogfoot was perfectly suited for flying among the stony hills and narrow valleys of Afghanistan. The T-8 could make 5.2 G turns with a full weapons load and manage a 6.5 G turn with a 1.5 ton load at low altitude. The Afghanistani Mujahideen rebels called the Frogfoot "The German Product." This nickname was based on the widespread disdain Afghan resistance fighters felt towards Soviet weapons and the combat skills of Soviet troops in general and pilots in particular. The deadly efficiency of the *Grach* suggested to the Afghans that it was very different from other Soviet weapons — so it must not be Soviet made.

Combat experience in Afghanistan led to a number of improvements in the Frogfoot A. The responsibility for a survival improvement modification program (started in 1988) rested with Piotr Lyrschykov of the Sukhoi OKB. Besides making these modifications to aircraft on the production line, all surviving T-8 preproduction aircraft were also upgraded and were usually modified when they returned from Afghanistan for overhaul or repair.

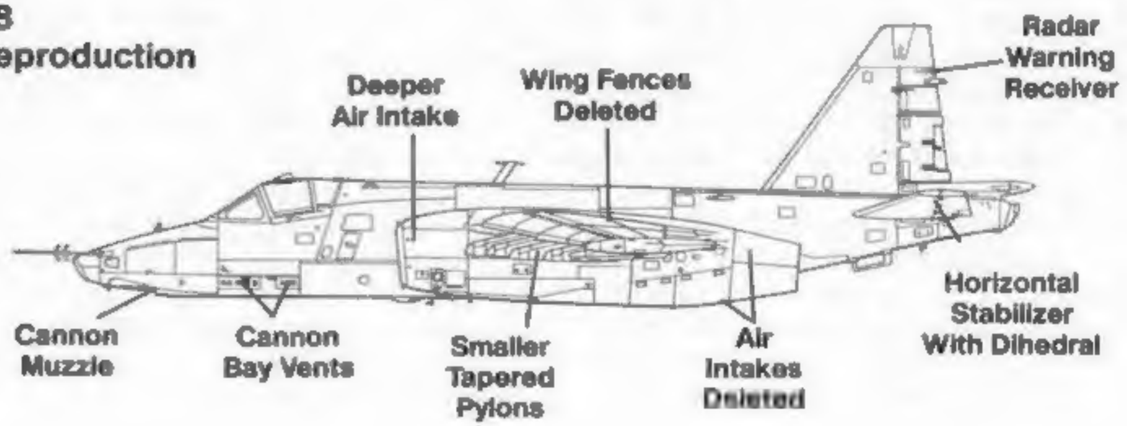
One shortcoming in the Frogfoot detected during the combat operations was that the twin engines were not separated enough. Often when ground fire or a Stinger missile hit led to a fire in one engine, it would quickly spread to the other engine. This usually led to the loss of the entire aircraft. The modification program led by P. Lyrschykov was aimed at reducing this fire hazard. A 5MM thick section of armor plate about five feet (1.5 meters) long was mounted between the two engines as a firewall and a new Freon fire extinguisher system was installed in the engine nacelles. This modification was highly successful and no modified T-8s or Su-25s were lost over Afghanistan to engine fires caused by Stinger missile hits, although a number of aircraft were damaged.

Fuselage Development

T-8-2 Prototype



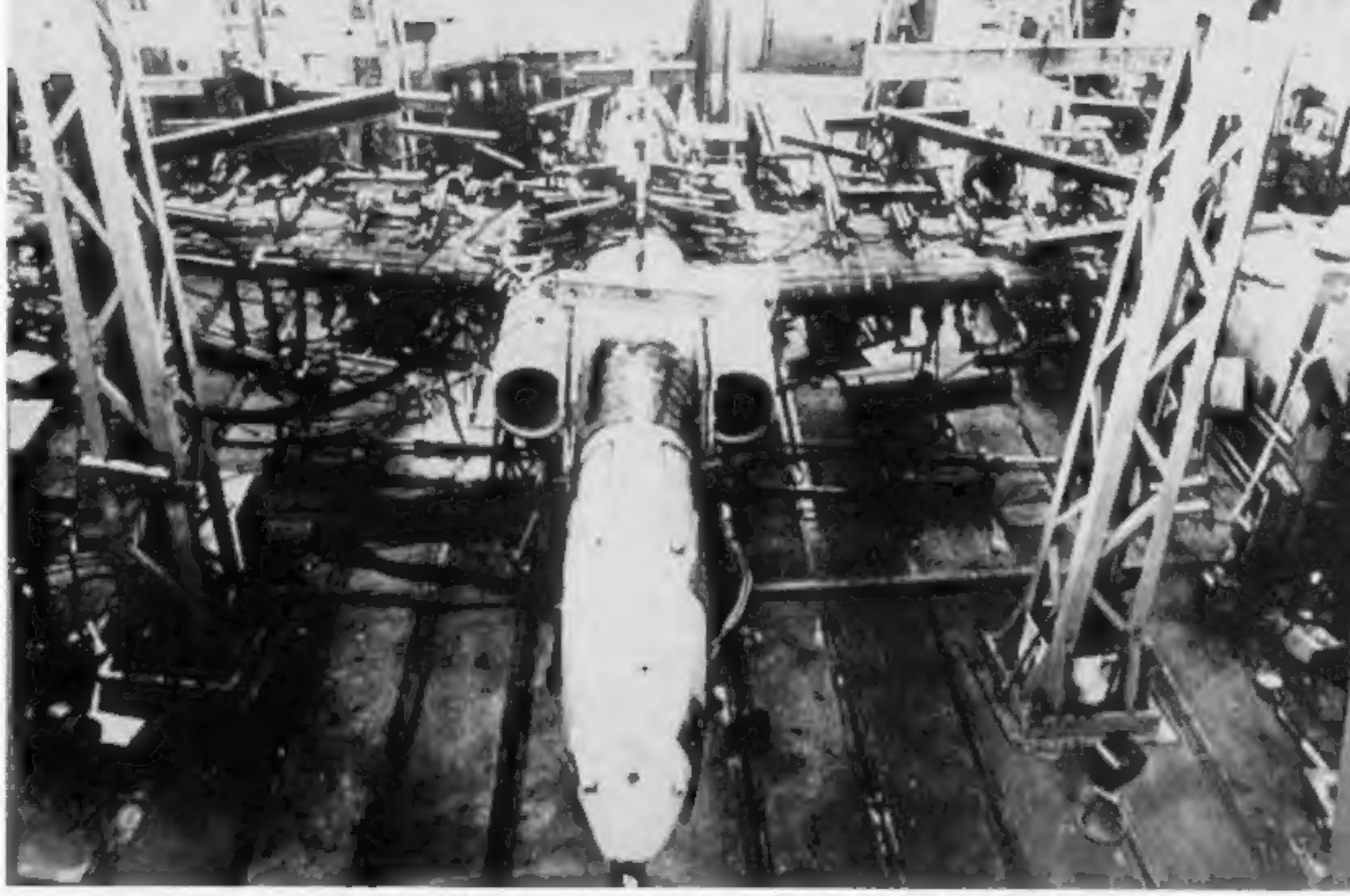
T-8 Preproduction



Another survivability modification was the addition of two bolt-on ASO-2V chaff/flare launchers on the rear engine nacelle. Again this modification was aimed at reducing the threat from Stinger surface-to-air missiles. Another modification done to the T-8 was aimed at reducing the temperature of the engine exhaust (IR signature) by installing a large cooling air intake on top of the rear engine nacelle along with another smaller intake on the bottom of the engine nacelle. Air from these intakes was ejected into the exhaust stream through a cooling tube located in the exhaust stream and projecting beyond the exhaust pipe.

When Soviet troops were withdrawn from Afghanistan in February of 1989, Frogfoot As were assigned to units within the Soviet Union, Poland and the German Democratic Republic. While most of these were in fact production Su-25s, a small number were pre-production T-8s. These aircraft were assigned to the 368th ShAP (*Shturmovoi Aviapolk*, Ground Attack Regiment), 16th Air Army based at Demmin-Tutow, Germany.

The T-8s of the 368th ShAP carried an Asian camouflage scheme, which consisted of a three tone upper surface pattern of Earth Brown, Dark Sand and Olive Drab over Light Blue undersurfaces. Red two digit tactical numbers were carried on the nose, outlined in White and the national insignia was carried on the top and bottom of the wings and on the vertical stabilizer. Some early T-8s were painted in a two tone camouflage consisting of Earth Brown and Sand uppersurfaces over Light Blue undersurfaces.



A preproduction T-8 Frogfoot A undergoes structural static testing at the Sukhoi experimental shop in Moscow. This aircraft was tested to destruction to determine the strength of the wings and fuselage. (Yefim Gordon)

This preproduction Frogfoot A, T-8-15, Blue 15, was rebuilt by Sukhoi after it was shot up twice over Afghanistan. During its rebuild, the Frogfoot was modified with the latest changes developed from combat experience including: chaff/flare dispensers on top of rear engine nacelle, cooling air intakes on the top and bottom of the nacelle and a cooling tube in the exhaust. (Sukhoi OKB)

The T-8-15 lands after conducting a demonstration at Kubinka. In preparation for a visit to the Paris Air Show, the aircraft was modified with an electronics probe on each side of the lower nose. These probes were for special avionics and navigational equipment installed in the aircraft for the flight to Le Bourget, France. (Steven Zaloga)

For the display at Le Bourget, T-8-15 (Blue 15) was repainted with the Paris Aero Salon participation number 301 on the nose in Blue with a White outline. For the public display, the aircraft had the window for the laser designator faired over. (Air Forces Monthly via David Oliver)

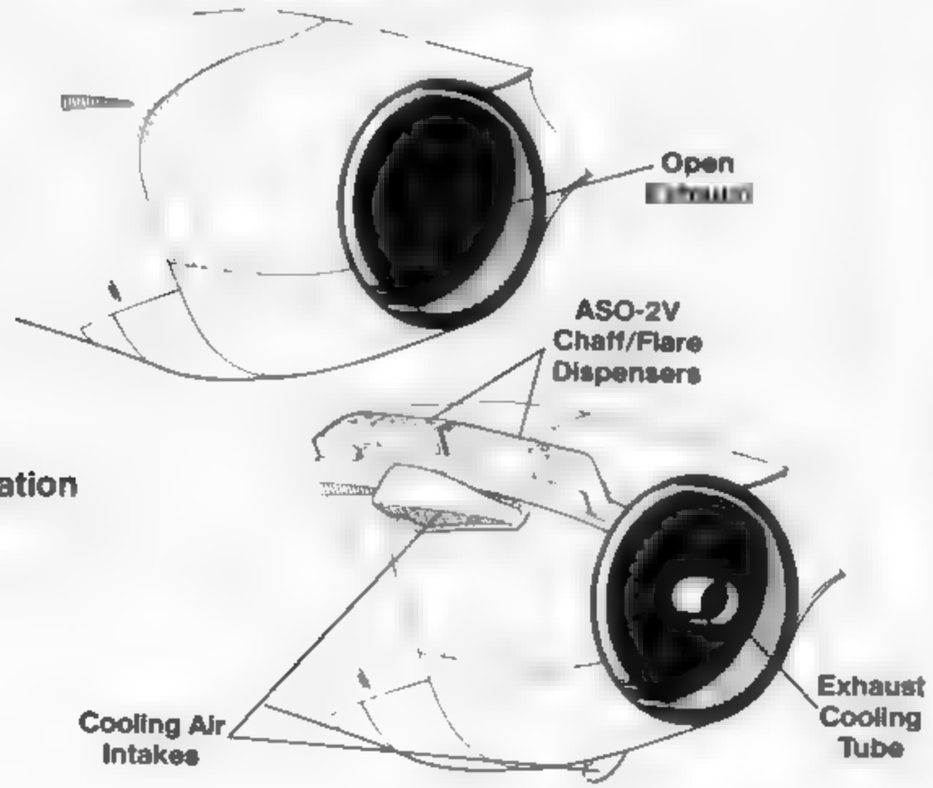
After the Paris Air Show, T-8-15 was used to conduct a number of weapon trials. One test involved carrying eight Sd-25 330mm unguided rockets on the inboard wing pylons along with R-60MK (AA-8 Aphid) missiles on the outboard wing pylons. The special nose probes fitted for the flight to Le Bourget have been deleted. (Yefim Gordon)

Another weapons test involved the use of the S-240 unguided rocket. The aircraft can carry eight such rockets and two R-60MK air-to-air missile. The S-240 is normally used as a counter-air weapon against airfields and aircraft parked in the open or in open revetments. (Yefim Gordon)

Because of the threat from Stinger missiles in Afghanistan, the Frogfoot A was modified to both reduce the IR signature and to provide some self defense from these missiles. A large cooling air intake was installed on the upper rear engine nacelle along with a smaller intake at the bottom of the nacelle. A cooling tube was installed in the exhaust stream and ASO-2V chaff/flare dispensers were fitted to each side of the nacelle. (Harry Wisch)

After a long and eventful operational life, the T-8-15 was transferred to Khodinka Airfield in Moscow during the Summer of 1991. The aircraft was on display in the new aviation museum built on this field. (Harry Wisch)

Engine Nacelle Development



After the end of the Afghanistan War, a number of T-8s were assigned to the 368th ShAP at Demmin-Tutow, Germany. The large cooling air intakes on the late preproduction T-8 are unique to this variant and were not used on production Su-25s. (Jens Schymura)

A T-8, Red 09, of the 368th ShAP, 16th Air Army at Demmin-Tutow, Germany. On most practice missions flown by this unit, the aircraft are configured with a pair of PTB-1150 drop tanks on the inboard underwing pylons. One of the main shortcomings of the Frogfoot A is its short endurance. (Jens Schymura)

A T-8, Red 15, of the 368th ShAP on final approach to its home base of Demmin-Tutow, Germany. All T-8s assigned to this unit are camouflaged in a Tan, Brown, and Olive drab on the upper-surfaces over Light Blue undersurfaces. The tactical number is in Red with a White outline. (Jens Schymura)

This T-8, Red 16, of the 368th ShAP, carries the same camouflage as the others assigned to the unit, although it also has Red warning triangles painted on the air intake and on the exhaust. The retractable landing lights on the wing tip pods are deployed for landing. (Jens Schymura)

Su-25 Frogfoot A

The pre-production T-8 was soon followed by the first series production aircraft which were given the designation Su-25. These aircraft were externally very similar to the pre-production aircraft and for this reason the ASCC-Reporting Name. Frogfoot A, was not changed.

Externally, the main difference between the pre-production T-8 and the early production Su-25 was the introduction of an air intake on the fuselage at the base of the vertical stabilizer and a second air intake on the engine nacelle just ahead of the wing trailing edge Additionally, two circular antennas were mounted on the wingtip speed brake housing and a brace was installed on the housing just ahead of the speed brake.

The Su-25 Frogfoot can carry a weapons load of up to 8,800 pounds plus two R-60MK air-to-air missiles for self defense. The aircraft has a service ceiling (without bomb load) of 22,965 feet, although this is drastically reduced (16,404 feet) with full bomb load The maximum allowable takeoff weight is restricted to 38,250 pounds and the landing weight is 29,320 pounds Depending on the weapons load, takeoff speed is between 150 and 168 mph with the distance required (hard surface) being between 1,640 and 2,952 feet. The landing rollout (hard surface with braking parachutes) is 1,969 feet at normal landing weight.

The relatively heavy weight of the Frogfoot A and the weight of its weapons load revealed another shortcoming in the design. The radius of a combat loaded Su-25 is limited to some 310 miles. For ferry flights up to four 305 gallon PTB-1500 drop tanks can be carried; in this configuration the aircraft has a range of 1,211 miles.

An unique feature developed to permit forward deployment of the Su-25 is a set of special support and maintenance equipment which can be carried in pods on the underwing pylons. The set is carried in four pods with the main pod carrying test equipment capable of checking all aircraft systems for up to twelve days. The second pod contains protective covers and plates. The third contains an electrical generator pack and all other equipment needed for aircraft electrical system maintenance and starting. The fourth pod houses pumps for use with forward fuel supplies including pillow tanks, drums or cisterns.

The internal armament consists of a single AO-17A twin barrelled 30MM cannon which can be used against both ground and air targets The AO-17A is carried on port side of the lower fuselage while the ammunition supply of 250 rounds is located in a bin on the starboard side. To accommodate the cannon and its ammunition the nose wheel was offset to port some 4.3 inches.

The Su-25 Frogfoot A can carry a wide variety of underwing ordnance including UB-32A rocket pods with thirty-two 57MM S-5 unguided rockets, UB-32A-24 rocket pods which can be distinguished by the curved rear covering, B-8M1 rocket pods with twenty 80MM S-8 unguided rockets, the S-24 240MM and S-25 330MM guided rockets, air-to-surface guided missiles, a wide variety of free-fall bombs and air-to-air missiles for self defense.

The air-to-surface guided weapons include the H-23 (NATO name AS-7 Kerry) which is launched from the APU-68-UM2 rocket/missile rail The H-23 has a 244 pound armor piercing warhead for use against tanks, armored vehicles and fortifications. The H-25 (NATO name AS-10 Karen) is also launched from the APU-68-UM2 rail and is available in three variants the anti-radar radiation homing H-25MP, the H-25MR with command data-link guidance and the H-25ML with semi-active laser homing. The H-25 has a 244 pound warhead and a range of 6.2 miles There are also two versions of the H-29 (NATO name AS-14 Kedge) in service the H-29ML with a semi-active laser homing seeker and the H-29T with a television guidance system. The H-29 has a 551 pound warhead and a range of 7.5 miles.

When a laser guided weapons is carried, such as the H-25ML or H-29ML, a laser illuminator pod must be carried to designate the target. While the Su-25 has a built in laser designator/ranger, the unit lacks the necessary power to illuminate the target for the laser guided ASMs. It is Russian policy that the same aircraft both launch the weapon and illuminate the target. This has a disadvantage in that when the missile is fired, the smoke and vibration from the firing makes it difficult to accurately maintain the laser illumination beam on the target.

For self defense, the Su-25 can carry two R-60 (NATO name AA-8 Aphid) or the more advanced R-60MK air-to-air missiles on the outboard wing pylons. These are launched from an APU-68-1M missile rail The R-60 is a close in "dog fight" air-to-air missile which can be launched as close as 1,312 feet from the target. In tests, some ninety percent of missile firings resulted in a hit.

A large variety of free fall bombs can also be carried on the eight wing stations, each with a maximum weight of 1,102 pounds These bombs fall into several categories including FAB bombs (*Fugasnaya Aviatsyonnaya Bomba*, general purpose bomb) and the OFAB bombs (*Oskolochnaya Fugasnaya Avia* Bomba, fragmentation/demolition aerial bomb) with weights of 220, 551 and 1,102 pounds. Some, including the OFAB-250ShN, are equipped with a parachute retard system for very low level bombing. Other bomb types in the Soviet arsenal include the PROSAB (cluster fragmentation aerial bomb), the PTAB (anti-tank aerial bomblet), the RRAB (rotary scatter bomb a cluster type munition), the KhAB (chemical bomb) and laser guided bombs. The MBD-3 multiple bomb rack can carry either four FAB-100, OFAB-100 (220 pound) or four FAB-50 (110 pound) bombs. The Su-25 can carry up to eight MBD-3 bomb racks.

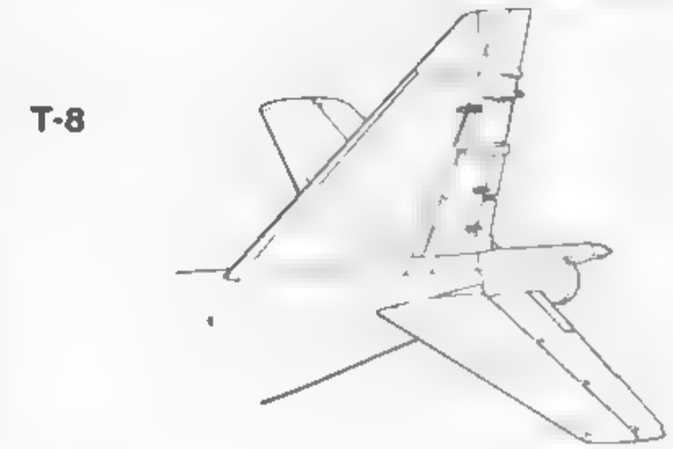
An early production Su-25, Red 01, shares the ramp with a Czech-built L-39 Albatros trainer. The aircraft is carrying a PTB-1150 fuel tank on the inboard pylon and an UB-32A-24 rocket pod on the number four pylon. This type of rocket pod with its rounded rear cover is seldom used on the Su-25 but is standard on the Mi-24 Hind. (Yefim Gordon)

An Su-25 Frogfoot A. Red 23, taxies off the ramp of its home base for a training mission. The tactical number on the nose has a thin White outline and the aircraft is equipped with the later blade style IFF antennas. (A.A. Zirnov)

This Su-25, Red 24, of the 357th ShAP at Brandis, Germany is armed with an FAB-100 220 pound bomb on pylon number three and an empty UB-32A rocket pod on pylon number four. The aircraft carries a *Grach* emblem on the air intake duct just behind the Red warning triangle. (Rene van Woezik)

Ground crewmen prepare a late production Su-25 Frogfoot A for its next mission. The four part wingtip speed brakes are fully deployed and the aircraft is equipped with the SRO-2 blade type IFF antenna on the nose. (V. I. Pashenko)

Fin Development



The Su-25 can be also equipped with the SPPU-22 cannon pod containing a twin barrelled GSh-23 23MM cannon and 260 rounds of ammunition. This gun pod was developed for use against troops and soft skinned vehicles. The gun can be depressed up to a maximum of 40 degrees from the horizontal during flight. The cannon is initially aimed by the pilot, then the fire control computer takes over to keep the cannon on target. The SPPU-22 can also be used to engage aircraft and helicopter in an air-to-air mode. For operations in a high threat area, the Su-25 can carry the SPS-141 ECM (Electronic Countermeasures) pod.

The Su-25 has been progressively improved over the years. Early production aircraft had a curved rigid canopy support rod which made pilot entry/exit from the cockpit difficult. Later production models have had this support replaced with a straight support rod which holds the canopy open further, increasing the entry/exit room for the pilot.

The early Su-25s and T-8 pre-production aircraft carried a single piece air brake on the wingtip which was split in the center and opened to an angle of fifty-five degrees. These were replaced on later production aircraft by a four piece "Crocodile" speed brake. The extra two speed brake plates are controlled separately to more accurately control air speed during attack runs and on landing

Early Su-25s had two White/Orange braking parachutes which were the same as those used on the MiG-23ML and MiG-27 These were housed in a container at the base of the rudder Later production variants carry two larger Tan parachutes, which helped reduce the landing run. Since these parachutes were often exchanged between aircraft, the color of the parachute alone is not an indication of whether the aircraft is an early or late production Frogfoot A.

Early Su-25s had a trim tab on the outboard flap while later variants had this trim tab deleted. On late production Su-25s, a metal anti-glare plate was fitted to the wingtip pod to protect the pilot from the bright light of the retractable landing light which was carried under the pod. Some early versions of the Su-25 had an access hatch on the outboard center of the wingtip pod. Another modification, carried only on Soviet Air Force Su-25s (and on some T-8s), consisted of a small triangular fairing carried on top of the wingtip pod just in front of the speed brake.

The landing gear on early Su-25s was equipped with a small landing light on the nosewheel strut and on each of the two main landing gear struts. This was replaced on the late Su-25 by a single large landing light on the nosewheel strut, while the small landing lights on the main landing gear struts were deleted.

The three-pole IFF antenna for the SRO-1P IFF system (NATO name Odd Rods) found on early production Su-25s was changed to the SRO-2 IFF blade antenna on late production aircraft These antennas are carried on top of the nose in front of the cockpit and on the lower fuselage under the tail

The AO-17A 30MM twin barreled cannon on the early Su-25 had a two piece muzzle brake, which was replaced by a more aerodynamic single piece muzzle brake on later Frogfoot As.

Based on combat experience in Afghanistan, Su-25s were progressively updated with additional armor and a four unit ASO-2Vchaff/flare dispenser on each side of the fuselage along-side the vertical fin. Additionally, a two row chaff/flare dispenser was installed on each side of the upper rear engine nacelle. This bolt-on fitting was added to aircraft on the production line and retrofitted to earlier aircraft in the field as an update kit. Together with the four units already carried on the fuselage, a total of 256 chaff flare cartridges could be launched in case of a Redeye or Stinger missile attack.

There were two different types of chaff/flare cartridges used: the PPI-Type which uses small needles dispersed over a wide area to confuse radar and the T-Type which uses a magnesium parachute flare to decoy heat seeking ground-to-air and air-to-air missiles. In many cases, the dispenser was loaded with a mix of PPI-Type and T-Type cartridges and a full load was usually sufficient for six to eight missile engagements.

Late production versions of the Su-25 were powered by an uprated R-195 powerplant which increased the aircraft's top speed from 528 mph to 621 mph.

Soviet pilots praised the handling qualities of the *Grach* and the great amount of battle damage the aircraft can absorb and still return to base At the same time they noted a number of shortcomings. Some of the complaints were that the aircraft was not fitted with specialized night flying/fighting systems, the fire control computer and navigational system were felt to be inefficient and needed to be replaced by a more accurate system which would allow combat missions to be flown in bad weather conditions and at night.

Other complaints centered around the electronic countermeasures equipment which was felt to be inadequate. Pilots reported that the aircraft lacked endurance partially because of the poor craftsmanship of the aircraft skinning which increased drag. Another problem was the lack of an anti-radiation air-to-ground missile. The lack of an autopilot hindered pilots on longer missions and the aircraft was unstable when taxiing on unprepared fields under crosswind conditions (due to its narrow track landing gear).

By 1989, when the Su-25 production line was closed at Tbilisi, some 330 Su-25s (and export Su-25Ks) had been built. This production run is low by Soviet standards with an average production of only two aircraft per month. This low production rate was because the Ministry for Aircraft production assigned other aircraft, such as MiG-29, Su-27 and multi-purpose aircraft as the Su-17M, a greater production priority in the Five Year Plan.

A pair of early production Su-25s return from a training sortie with empty S-25 aircraft rocket launch tubes on the number two pylon. These large 330MM rockets were first operationally tested in Afghanistan and found to be highly valuable against hard targets, such as caves and bunkers. (Yefim Gordon)

Then, with the beginning of *Glasnost* and the wind-down of Soviet defense spending, the Su-25 became a victim of defense budget cuts.

It is an interesting fact that the Soviet Union had worked out a plan during 1977 (some two years before production got underway) that all Su-25 production would be undertaken by the P.Z L. Company at Mielec, Poland and no Su-25s would be produced in the Soviet Union. At this time it was thought that the Su-25 should be produced in vast numbers for the Soviet Union, all members of the Warsaw Pact, and other foreign customers. In the late 1970s, Soviet doctrine called for the building of a large tactical air force to support the ground forces and the Su-25 was deemed as very suitable for this duty In the event, the Polish Air Force rejected the Frogfoot and the plan was cancelled.

By 1988, there were about 220 Su-25s in the Soviet Air Force inventory assigned to five Aviation Assault Regiments. These regiments were based in Russia, Byelorussia, the Ukrain and Turkestan. In February of 1989 a regiment was transferred to Poland and two were deployed to the German Democratic Republic. With the fall of the Soviet Union, it is most likely that the single Su-25 Aviation Assault Regiment under the command of the 14th Air Army at Lvov, in the Ukrain will be absorbed in the newly formed Ukrainian Air Force.

The two Aviation Assault Regiments in the former German Democratic Republic are under the command of the 16th Air Army A *Shturmovoi Aviapolk* (Aviation Assault Regiment) consist of three *Eskadrili* (squadrons) with a total of thirty-six to forty-five Su-25s and two Su-25UB trainers with an average squadron strength of twelve aircraft The 357th ShAP has flown the Su-25 for about five years and is based at Brandis and shares this airfield with the Mi-8 and Mi-17 of the 485th Combat Helicopter Regiment. Most of these aircraft assigned to the regiment carry the Sukhoi factory insignia on the stabilizer below the national marking. This unit operates Su-25s in three different camouflage schemes and some of the aircraft are known to carry the *Grach* emblem on the port air intake. Normally this marking is in Red, however, some Su-25s have the rook in Yellow. Most aircraft carry two digit tactical number with a thick White outline while a few have a thinly outlined number.

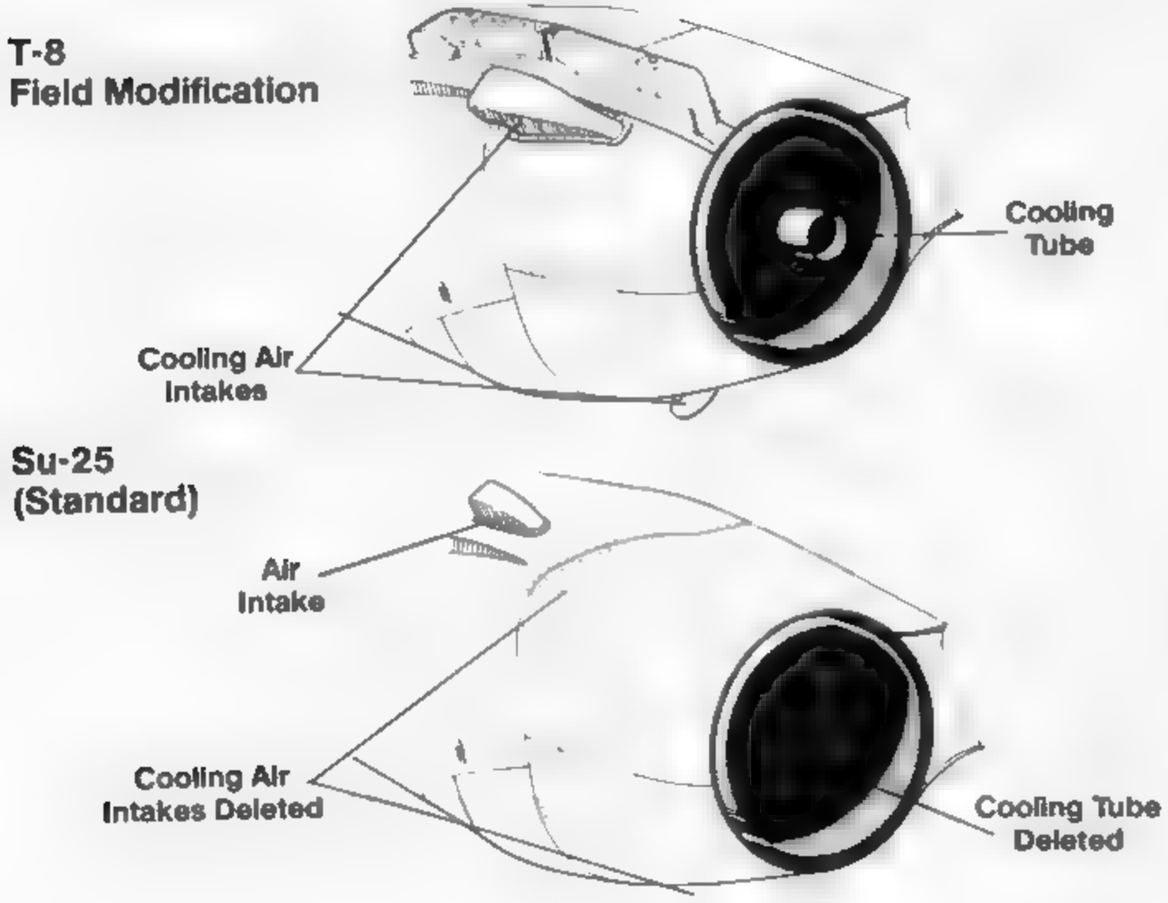
All the Su-25s assigned to the 368th ShAP based at Demmin-Tutow, carry an Asian camouflage scheme without the Sukhoi factory insignia, although the *Grach* emblem is sometimes carried on the port air intake. All these aircraft have a two digit Red tactical number with a large White outline.

When the two Germanies were reunited on 3 October 1990, the activities of the Soviet Units were restricted by the German government Training flights are forbidden on weekends and night flights are severely curtailed The 357th ShAP departed Germany for Russia on 28 April 1992.

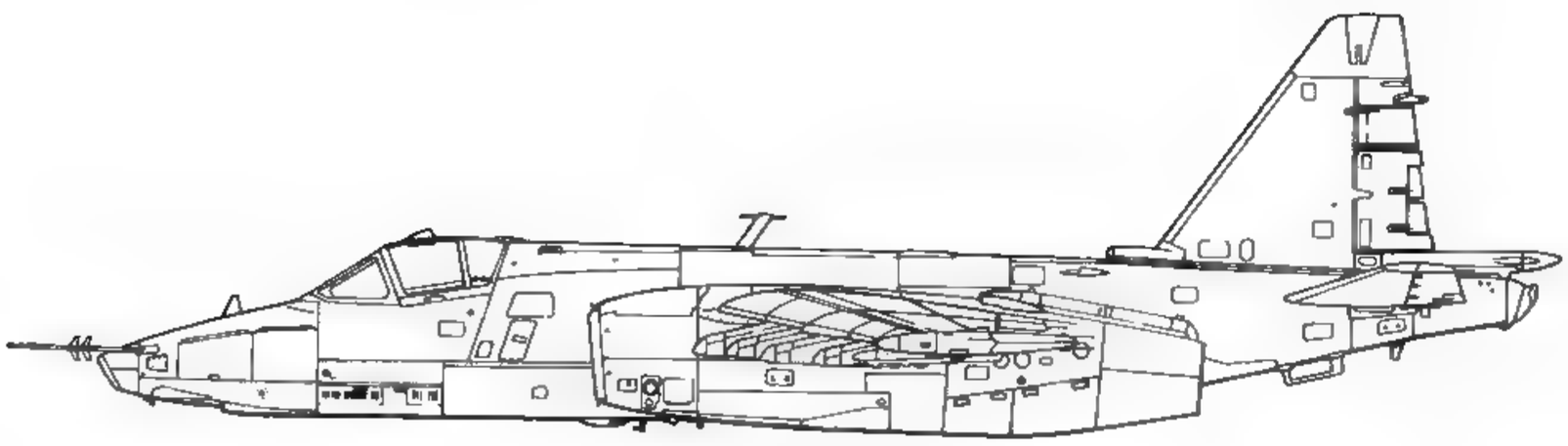
Su-25BM Frogfoot A

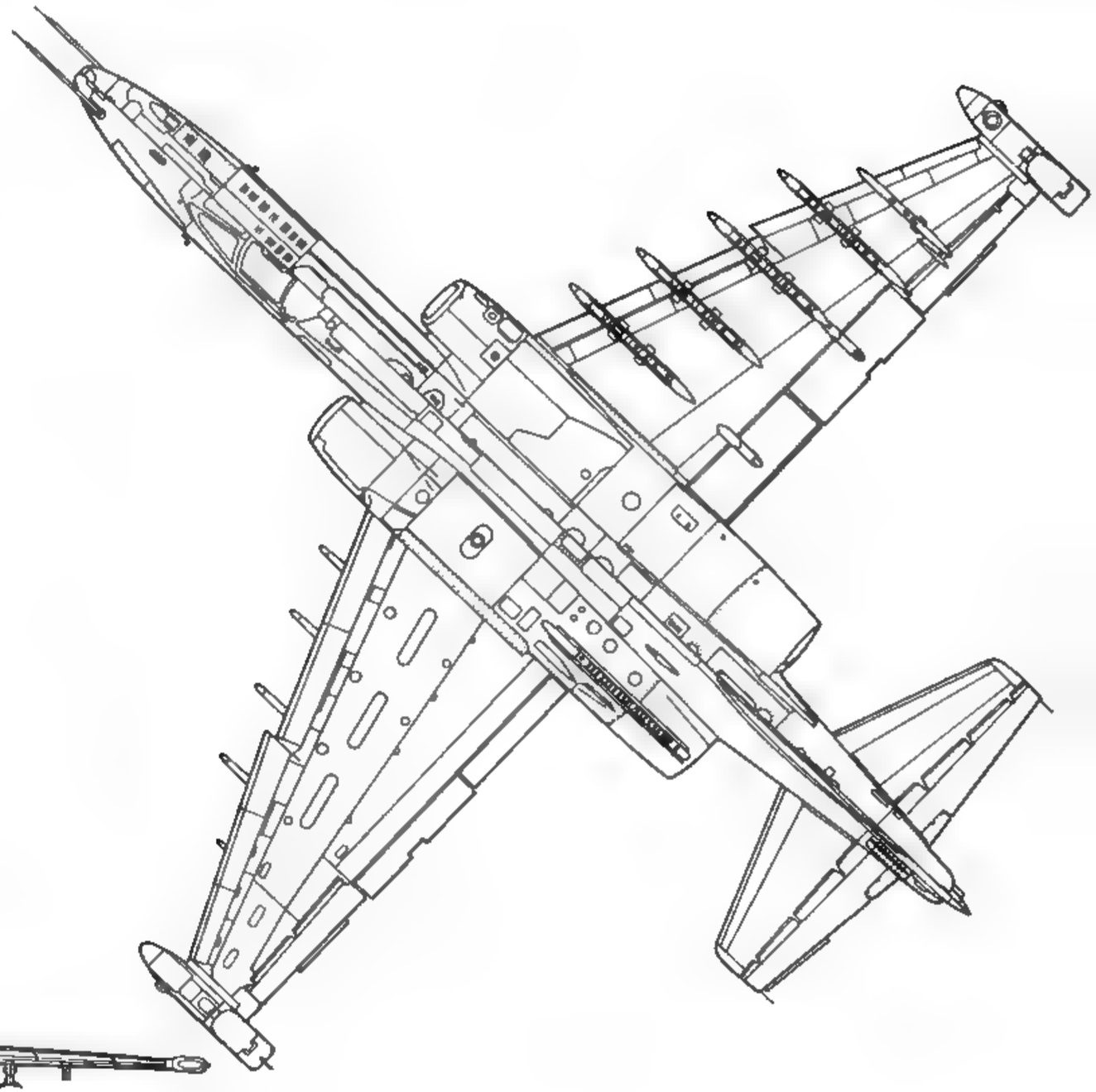
The Su-25BM (*Buksir Mishem*, target tug) is a variant of the Frogfoot A modified to tow aerial targets for air-to-air and ground-to-air gunnery training. The aircraft carries a TO-70 target winch and Kometa towed target on the inboard port underwing pylon. To lightened the aircraft, the internal cannon was deleted and the cannon port faired over. The export designation for this aircraft is the Su-25BMK.

Nacelle Development



This pair of Su-25s, White 72 and White 73, has a three tone camouflage scheme of Olive Drab, Dark Green and Earth Brown uppersurfaces over Light Gray undersurfaces. This camouflage scheme was rarely used on early Frogfoot As. The tactical number is a White outline style applied against the base camouflage. (Steven Zaloga)





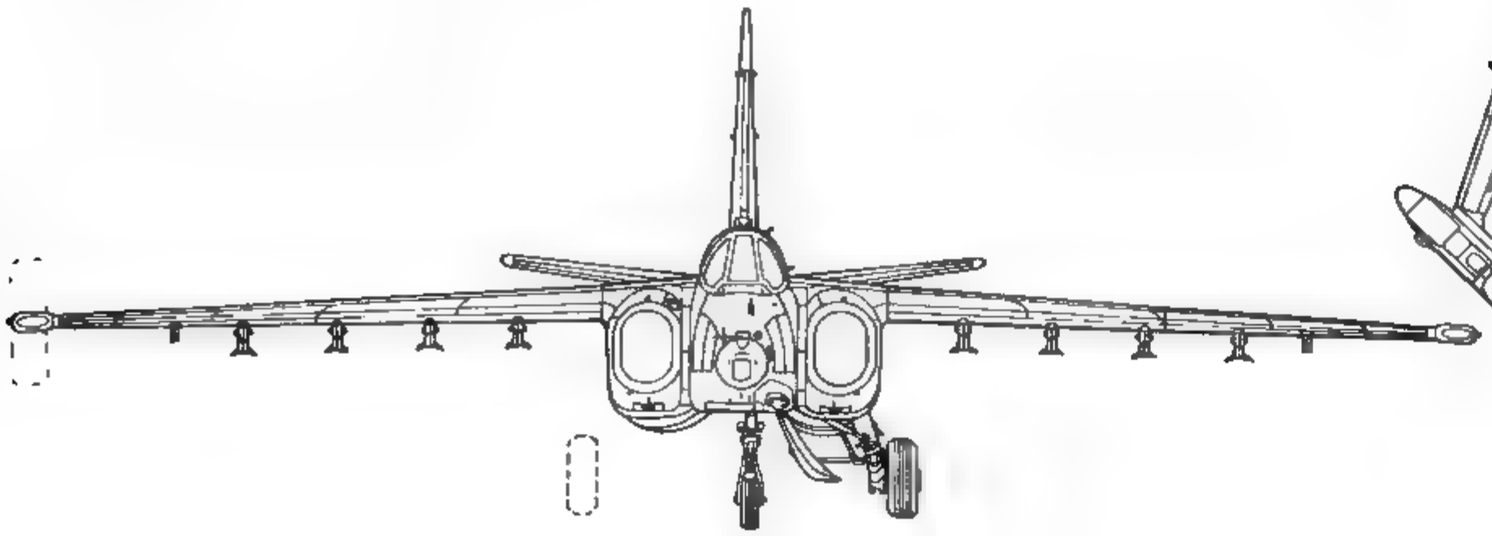
Specifications

Su-25 Frogfoot A

Wingspan ..... 47 feet 1.5 inches
Length ..... 50 feet 11.5 inches
Height ..... 15 feet 9.5 inches
Empty Weight ..... 20,950 pounds
Maximum Weight ..... 38,800 pounds
Powerplants ..... Two 9,921 lbst Tumansky R-95Sh turbojet engines

Armament ..... One twin barrelled 30MM cannon and ten underwing plyons for up to 9,700 pounds of ordnance.

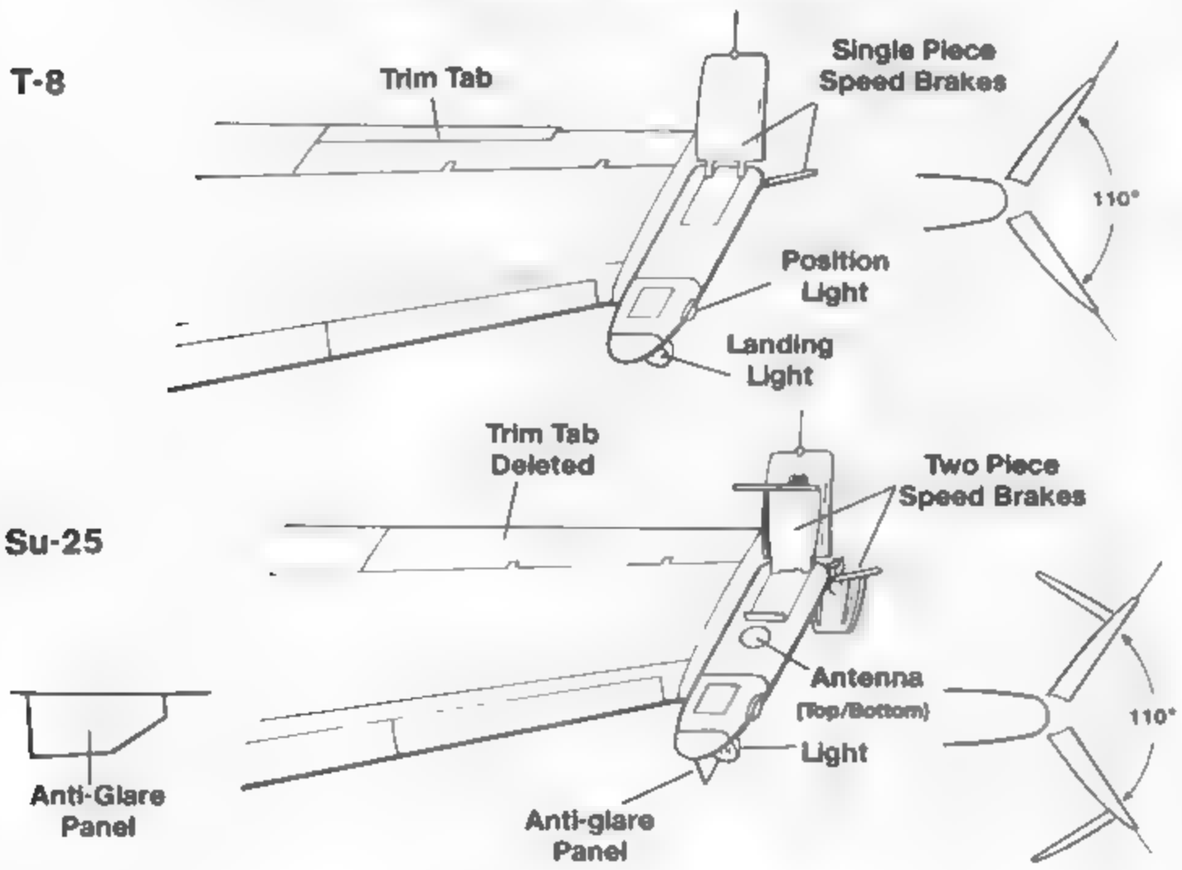
Performance
Maximum Speed ..... 606 mph
Service ceiling ..... 22,965 feet
Range ..... 1,212 miles
Crew ..... One



An Su-25 Frogfoot A, Blue 66, lands at Kubinka with the wingtip speed brakes and braking parachutes fully deployed. The Tan colored braking parachutes used on production Su-25s are larger than the earlier Red/White parachutes used on preproduction T-8s. (Steven Zaloga)

The late Su-25 had a modified wingtip pod with a sheet metal anti-glare panel between the aircraft and the retractable landing light. Additionally, the Su-25 differs from the T-8 in that the earlier aircraft did not have the round antenna in the center of the pod. (Marcus Fülber)

Speed Brake Development



This Su-25, Red 08, is armed with twenty-shot B-8M1 80MM rocket pods on each number four pylon. Although the landing gear is up, the retractable landing light is still in the down position. (Martin Baumann)

Although the built-in boarding ladder on this Su-25 Frogfoot A is deployed, a second portable ladder has been put inplace alongside the aircraft. In actual service the built-in ladder was rarely used and it was deleted on later variants. (A. A. Zirnov)

Red 14, a late production Su-25 Frogfoot A on the apron at Brandis, Germany. The tactical number has a very thin White outline on the nose and is repeated on the anti-glare panel. The aircraft carries a *Grach* emblem on the port air intake and a Sukhoi emblem on the fin. (Martin Baumann)

An Su-25 Frogfoot A parked on the ramp of its home base. There is a large amount of ordnance on the ramp including a UB-32A thirty-two shot rocket pod, an FAB 50 110 pound bomb and belted 30мм ammunition draped over the bin in the foreground. (V. I. Pashenko)

Several Frogfoot As share the ramp at their home base with a Frogfoot B trainer. The trainer has a taller fin and shorter rudder than the Frogfoot A. Normally, there are several trainers (either Frogfoot Bs or L-39s) assigned to each attack regiment. (A.A. Zirnov)

Red 02, rolls out after landing at Brandis with the drag chute container still open. The tactical number has a very thin White outline and is repeated in White on the missile rail on the outboard pylon. Reportedly, the Frogfoot units stationed at Brandis will be returned to Russia before 1994. (Martin Baumann)

This Su-25 Frogfoot A, Red 89, has the air intakes covered by Red protective covers designed to keep foreign object out of the intake while the aircraft is parked. (A. A. Zirnov)

Red 25 on final approach for landing at Brandis, Germany. This Frogfoot A has its former tactical number overpainted with a glossy Light Blue dot and the new tactical number added on the dot. The Light Gray area to the left of the tactical number may be an overpainted "Excellent Aircraft" badge. (Vincenz Schütz)

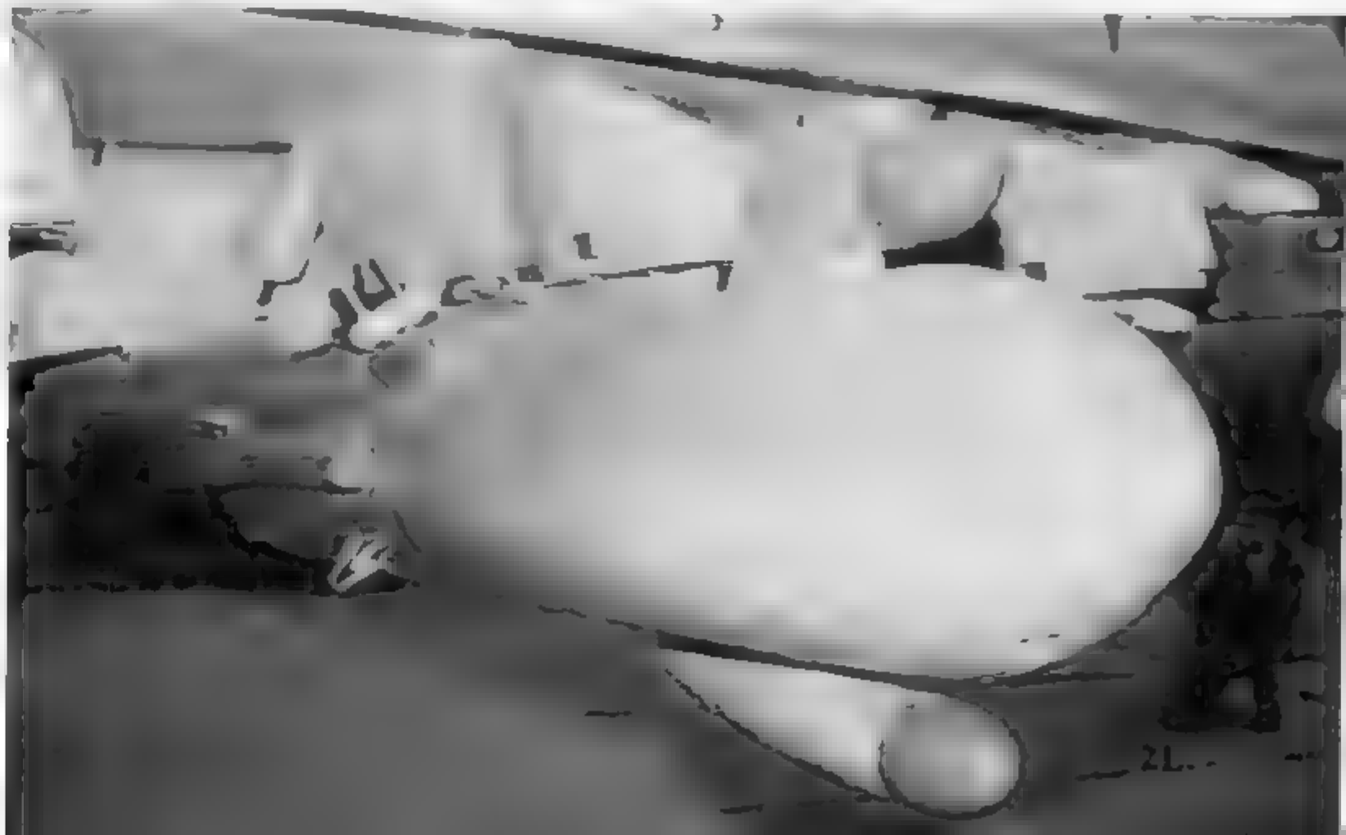
This Su-25, Red 06, although equipped with the early style small White/Orange braking parachutes is actually a late production aircraft. The aircraft has a White nose, which probably denotes its squadron assignment. The helicopters in the background are Mi-17MT Hips of the 485th Combat Helicopter Regiment. (Rene van Woezik)

This Su-25, Red 30, of the 357th ShAP at Brandis, Germany carries a mottle camouflage scheme of Light Brown sprayed over the standard Central European camouflage scheme. A Red *Otlitshnij Samolot* (Excellent Aircraft) badge has been painted on the nose of this *Grach*, a marking that is rarely seen on Su-25s. (Rene van Woezik)

White 18, a Su-25 Frogfoot A of the 60th ShAP, was based at Sital-Zhay Air Base in Azerbaijan during February of 1990. The aircraft carries six B8M1 rocket pods, a typical load for a ground attack mission. The air intake warning triangle is in Black. (D. Grinyuk)

This Frogfoot A, White 12, was a combat veteran of the war in Afghanistan. The aircraft was assigned to the 60th ShAP after the war and based in Azerbaijan. Reportedly, the Su-25s of this regiment are scheduled to be part of the equipment taken on charge by the newly formed Azerbaijani Air Force. (D. Grinyuk)

An SPS-141 Electronic Countermeasures (ECM) pod on pylon three of an Su-25 of the 60th ShAP. The use of this ECM pod greatly improved the survivability of the Frogfoot in high threat areas. The dielectric radomes are Light Green in color. (D. Grinyuk)



This mottle camouflaged Su-25, Red 04, took part in an exhibition at Chojny Air Base in Poland during February of 1990 to show President General Wojciech Jaruzelski and a Polish military delegation the types of aircraft that were based in Poland as part of the Soviet Northern Group of Air Armies. (Wojciech Luczak)

The famous *Grach* emblem carried by this Su-25 based at Demmin-Tutow, Germany was the same as the insignia applied to a number of aircraft which saw combat in Afghanistan. The emblem is not a unit badge but refers only to the aircraft's nickname. The air intake warning triangle has its inscription in Cyrilic. This emblem belongs to the Su-25 "Red 12." (Marcus Fülber)

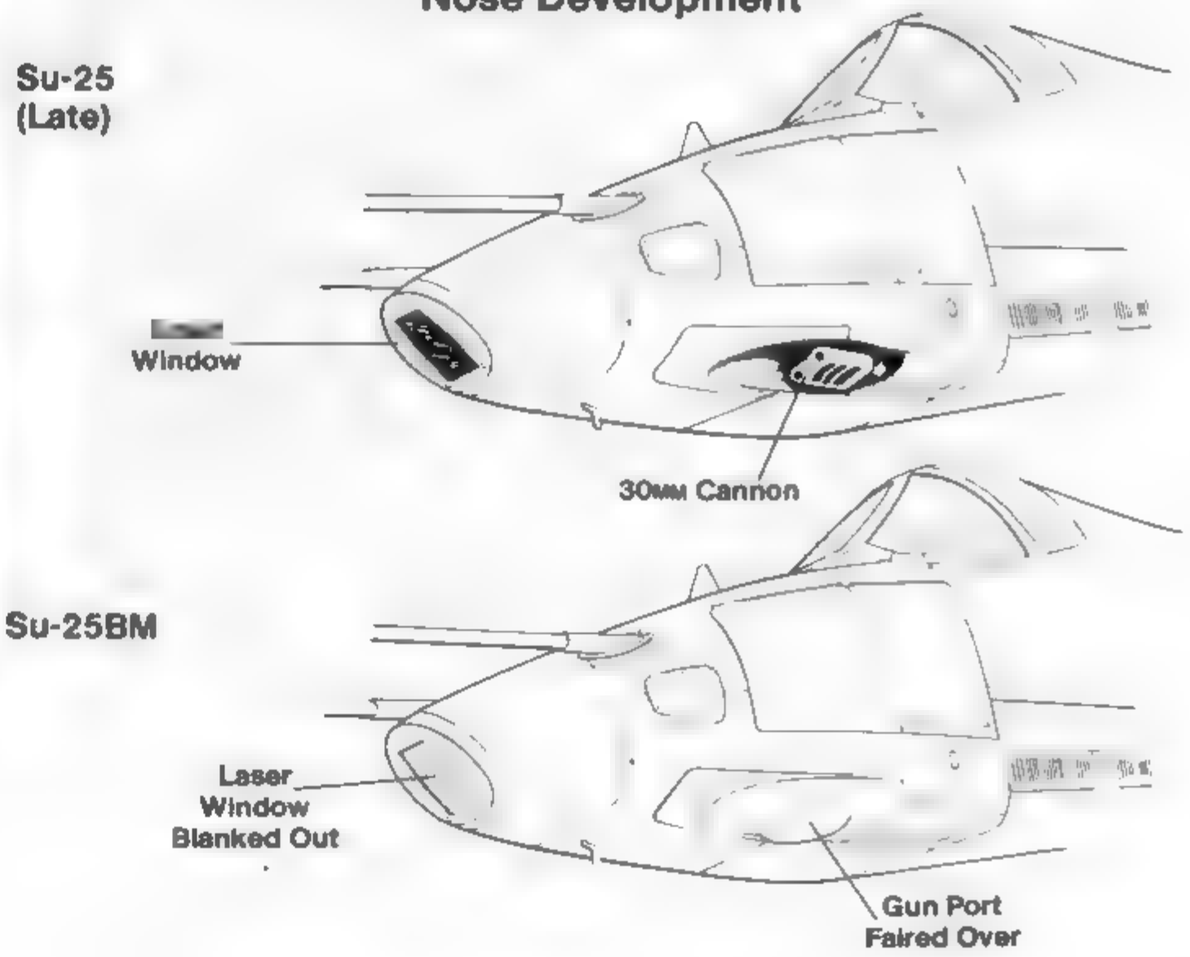
An Su-25 of the Soviet aerobatic team *Njebjesnije Gusarj* (Celestial Hussar) taxies in after a demonstration flight. The team was formed with aircraft and pilots of the 3rd Squadron of the Kubinka Regiment. These are standard combat ready Su-25s, not specially modified aircraft. (A. A. Zirnov)

A pair of *Njebjesnije Gusarj* Su-25 Frogfoot As take off to perform a demonstration flight. The team was formed during April of 1992 at Kubinka. The insignia on the tail is not a team emblem but rather the emblem of the Soviet Air Force. (A. A. Zirnov)

Red 12 was an Su-25BM target tug which had the internal 30mm cannon deleted to save weight and the cannon port faired over. These aircraft were used to tow aerial targets for both air-to-air and ground-to-air gunnery practice. (Harry Wisch)

In addition to having the gun deleted and faired over, the Su-25BM had the laser range finder/designator removed and the window blanked out. When in use, the towed target and cable reel was suspended from one of the underwing pylons. (Harry Wisch)

Nose Development



Combat in Afghanistan

Together with a number of T-8 preproduction aircraft, Su-25 Frogfoot As saw considerable combat service during the Afghanistan war. By 1984, the Soviet Air Force had deployed some twenty-four Su-25s and eighty pilots, assigning them to the 60th ShAP which had been formed from the 200th Attack Squadron. The unit operated from Bagram airfield near the Afghan capital of Kabul, and over the course of operations in Afghanistan two pilots were awarded the Soviet Union's highest award, Hero of the Soviet Union The first was LCOL Petr V Ruban (who was killed in action) and the second was CAPT Dyakov.

The unit's commander also had the authority to deploy additional Frogfoot As from regiments stationed over the border in the neighboring Turkestan Military District of the Soviet Union whenever combat operations required reinforcements.

A common mission for the *Grach* was close air support (CAS) for ambushed Army convoys. In this role, the aircraft was usually armed with UB-32A or B-8M1 rocket pods which could be salvoed in varying numbers depending on the target. This gave the Su-25 the same capability as an artillery battery. The *Grach* could deliver a great amount of ordnance with deadly accuracy, an accuracy that was never surpassed by any other Soviet aircraft or helicopter This made the Frogfoot the most hated weapon in the Soviet inventory by the Mujahideen. With its excellent maneuverability, the Su-25 could fly strikes into the small valleys and mountain passes that were inaccessible to other fixed wing attack aircraft.

In combat, the Su-25s usually operated in pairs. While one aircraft attacked the target, the second *Grach* flew top cover and watched out for possible threats such as anti-aircraft fire or shoulder launched ground-to-air missiles Another combat formation was the *Zveno* (flight) of four aircraft. This formation operated as combat pairs with one pair as attackers and the second as support.

The first use of the Su-25 in substantial numbers took place during April of 1984 when the Soviets launched a large and subsequently ill fated ground offensive in the Panjshir valley, a location defended by some two hundred heavy machine guns. The Afghan rebel defenses in the valley were later increased during 1985 with the addition of some thirty Swiss manufactured Oerlikon-Bührle 20MM anti-aircraft guns The Panjshir valley was of strategic importance since all truck traffic from the Soviet Union traveled via the Salang Pass and Panjshir valley to Kabul.

The Soviet attacks against Mujahideen positions also included occasional missions across the Pakistani border against Afghan rebel encampments on Pakistani soil. Soviet Su-25s were involved in several incidents with the Pakistani Air Force and some were lost to PAF fighters. Another duty was escorting civil Aeroflot aircraft, attacking any anti-aircraft position that fired on the Aeroflot aircraft.

Although not equipped for night operations, Frogfoot As were used in the night role during 1985 when a unit, now under the command of C OL Alexandr Rutskoy, began sustained night operations To spread out combat experience between units, the Soviet Air Force disbanded the unit during the war and assigned the pilots to other units fighting in Afghanistan.

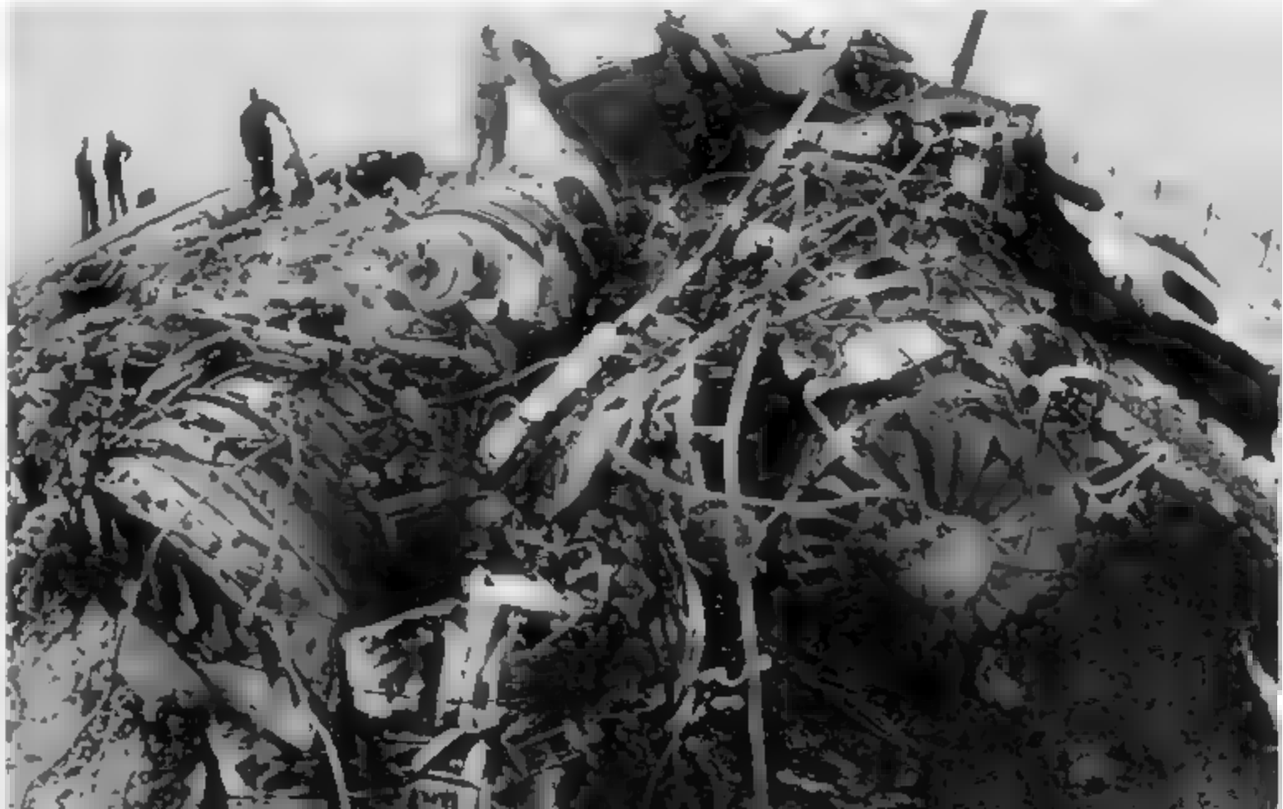
In April of 1986, during the Zhawar campaign, Soviet Su-25s first used laser guided, retarded and cluster bombs against the rebel positions including caves. Probably the most spectacular mission flown by the *Grach* was a precision air strike against the secret headquarters of Ahmad Shah Massoud, better known as the *Panjshir Valley Lion*, one of the most prominent partisan military leaders. The operation was lead by Flight Commander G. Stryepyetov and was a success.

Between 1980 and February 1989 a total of twenty-three Frogfoot As were lost in combat over Afghanistan and an additional number were destroyed on the ground by Mujahideen mortar/rocket attacks. In one such attack, on 23 June 1988, eight Su-25s were destroyed by artillery rockets during an attack on Kabul airport. These aircraft belonged to squadrons deployed from the Soviet Union and were not aircraft regularly assigned to units in Afghanistan.

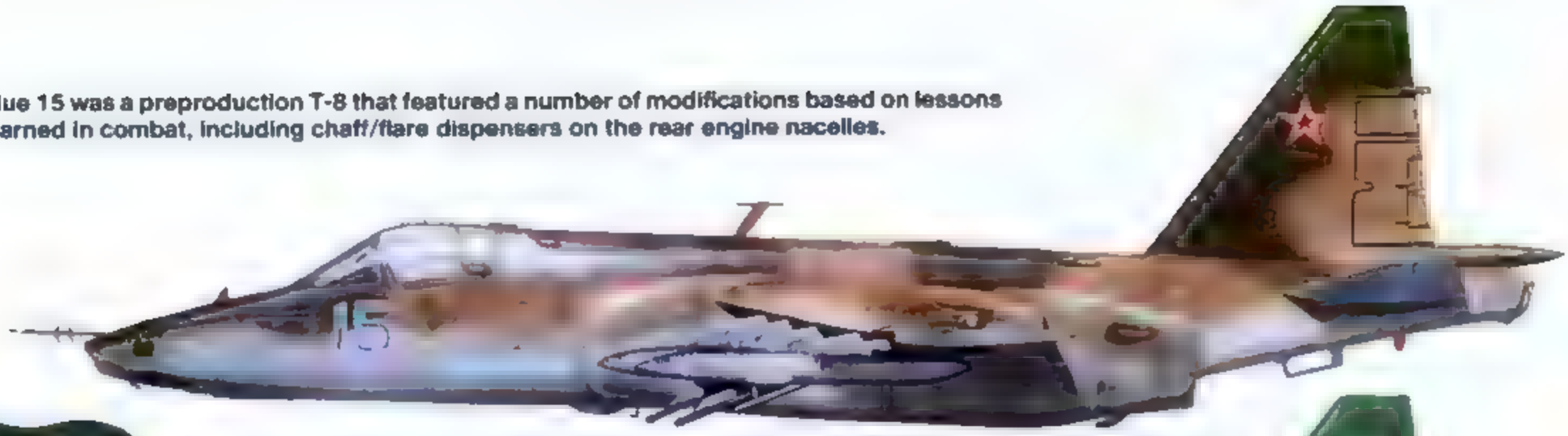
In 1984, two Su-25 were lost when the Mujahideen introduced the American-built Redeye shoulder launched anti-aircraft missile Later, in October of 1986, the first batch of some 200 General Dynamics FIM-82A Stinger missiles were delivered to the resistance fighters. By the time the United States ceased shipments (in early 1989) some 1,000 had been delivered to the Mujahideen. The Stinger was a more deadly weapon than the Redeye since its seeker was sensitive enough to lock on to the target at a wider range of angles Its warhead was more effective and it tended to explode closer to the aircraft, making its blast more deadly The seeker also had a filtration system to prevent the missile from being decoyed by the types of flares that had rendered the less sophisticated Strela 2 (SA-7 Grail) ineffective. In a three day period when the Stingers were first introduced, four Frogfoot As were shot down, killing two of the pilots. The alarming loss of these Su-25 in combat led to several modifications to improve the aircraft's survivability. Additional chaff/flare dispensers were fitted and armor plate was positioned between the engines. After these modifications were completed on all Frogfoot As in Afghanistan, there were no further losses to Stinger attacks although many aircraft were damaged.

The loss of twenty-three Su-25s in Afghanistan represented about ten percent all Soviet fixed wing aircraft losses over Afghanistan. The average was one loss for every 2,800 combat hours It was estimated that it took some eighty hits to bring down a Su-25, while other attack aircraft (Su-17, MiG-21) could be downed with only fifteen to twenty hits. Measured by Vietnam standards, the loss rate was not very high, but for the Soviets, it was a high figure.

This Su-25 was one of eight Frogfoot As destroyed on the ground at Kabul airport by artillery rockets on 23 June 1988. These aircraft belonged to a deployed unit that was not regularly attached to the Limited Contingent of Soviet Forces in Afghanistan. (Steven Zaloga)



Blue 15 was a preproduction T-8 that featured a number of modifications based on lessons learned in combat, including chaff/flare dispensers on the rear engine nacelles.

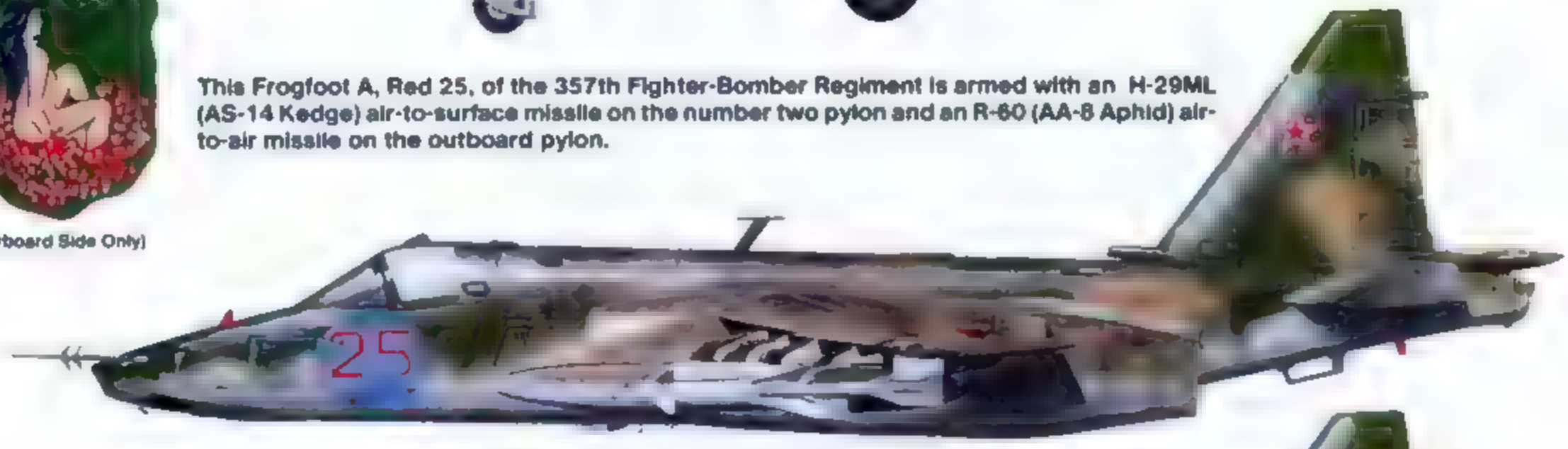


(Port Side Only)

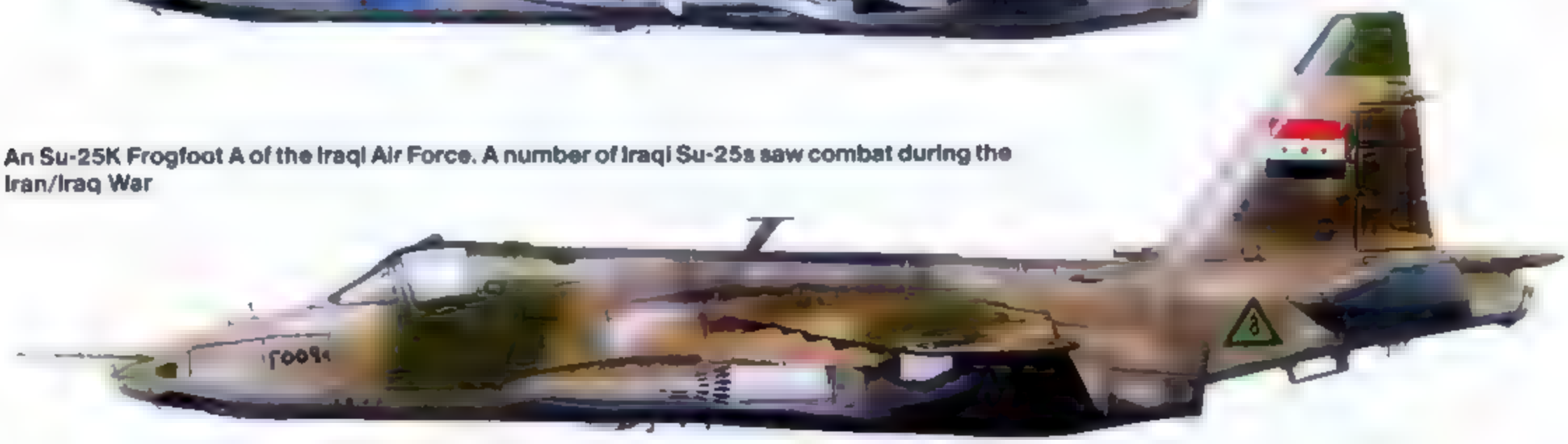
This Su-25K Frogfoot A of the 30th Attack Regiment, Czech Air Force carried a sharkmouth and a nude pin-up girl on the starboard side for a short period of time.

(Starboard Side Only)

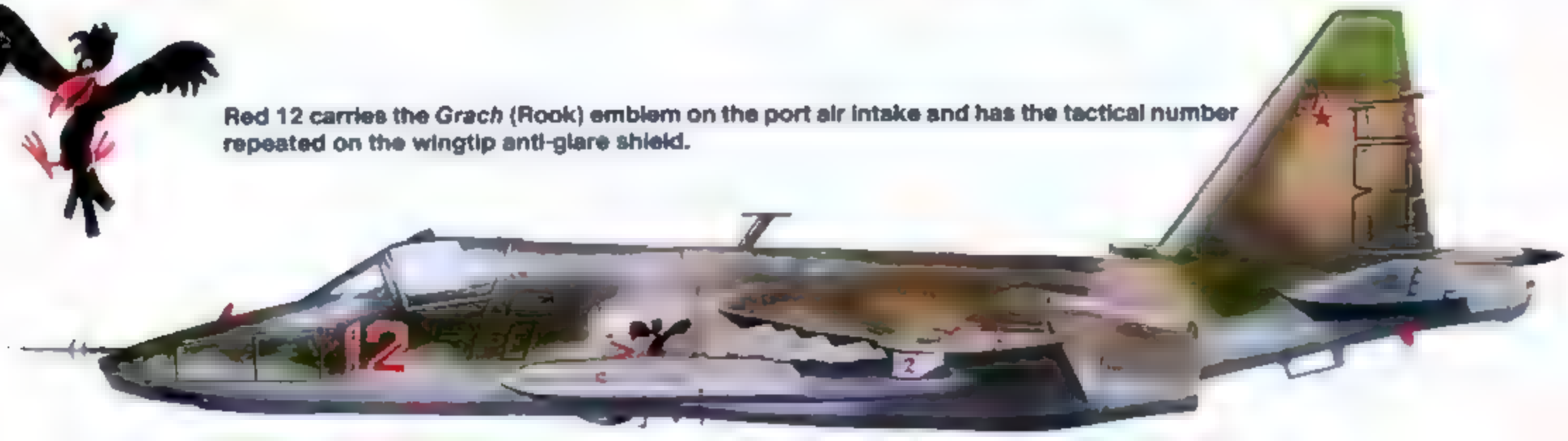
This Frogfoot A, Red 25, of the 357th Fighter-Bomber Regiment is armed with an H-29ML (AS-14 Kedge) air-to-surface missile on the number two pylon and an R-60 (AA-8 Aphid) air-to-air missile on the outboard pylon.



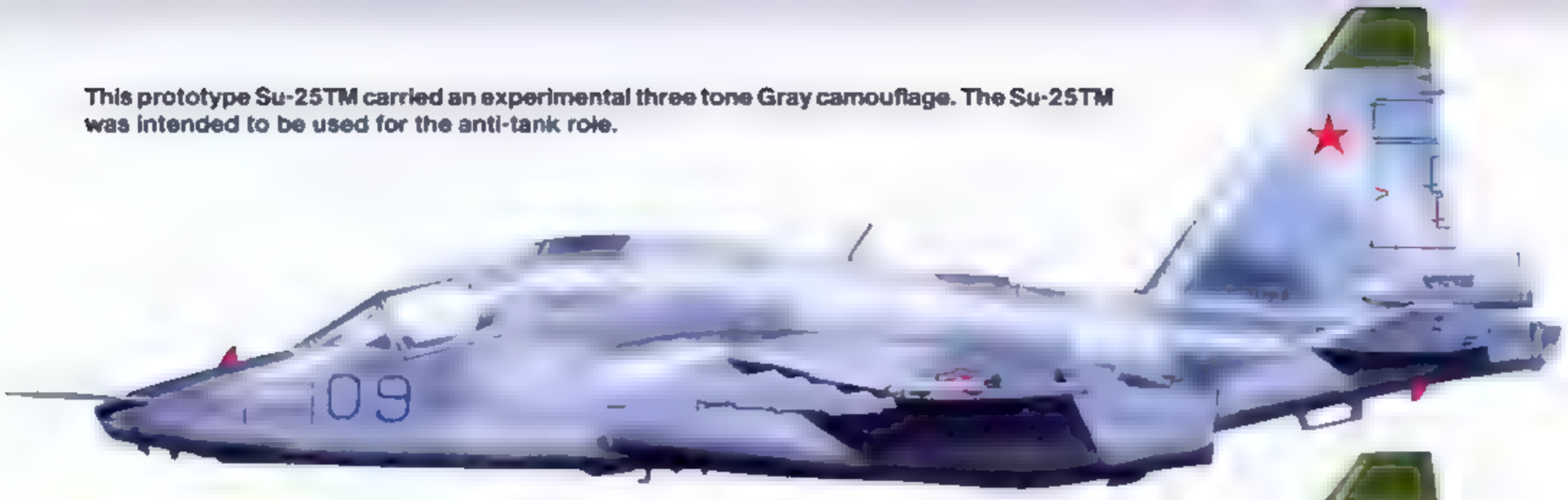
An Su-25K Frogfoot A of the Iraqi Air Force. A number of Iraqi Su-25s saw combat during the Iran/Iraq War



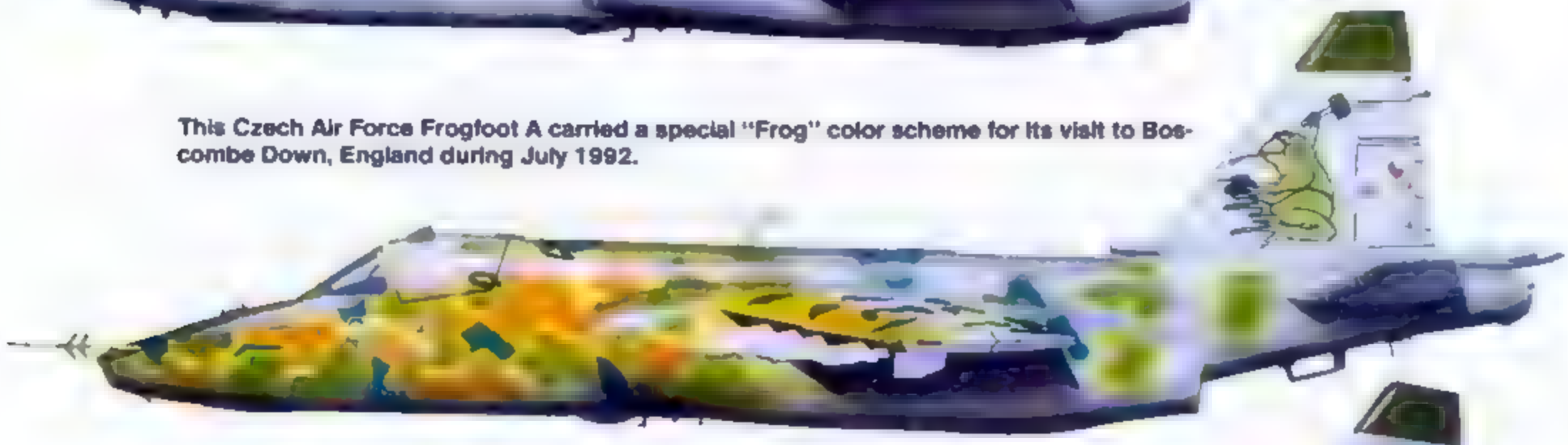
Red 12 carries the *Grach* (Rook) emblem on the port air intake and has the tactical number repeated on the wingtip anti-glare shield.



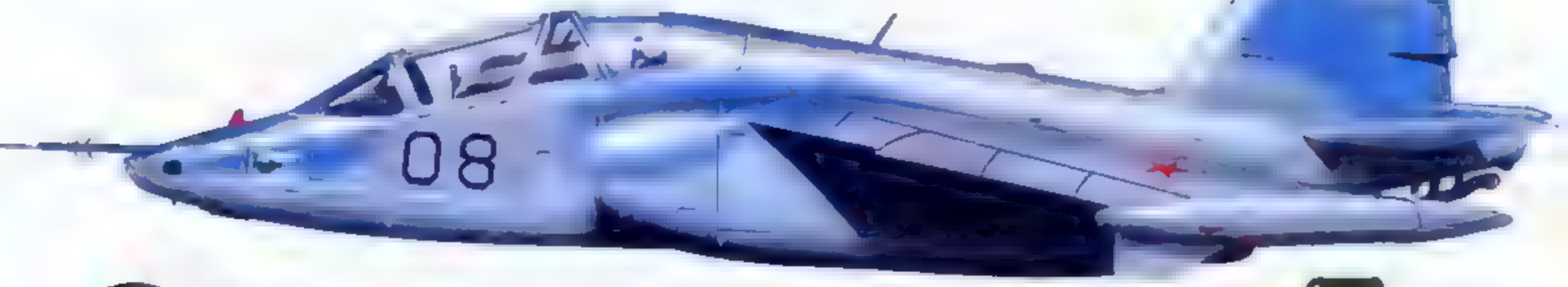
This prototype Su-25TM carried an experimental three tone Gray camouflage. The Su-25TM was intended to be used for the anti-tank role.



This Czech Air Force Frogfoot A carried a special "Frog" color scheme for its visit to Boscombe Down, England during July 1992.



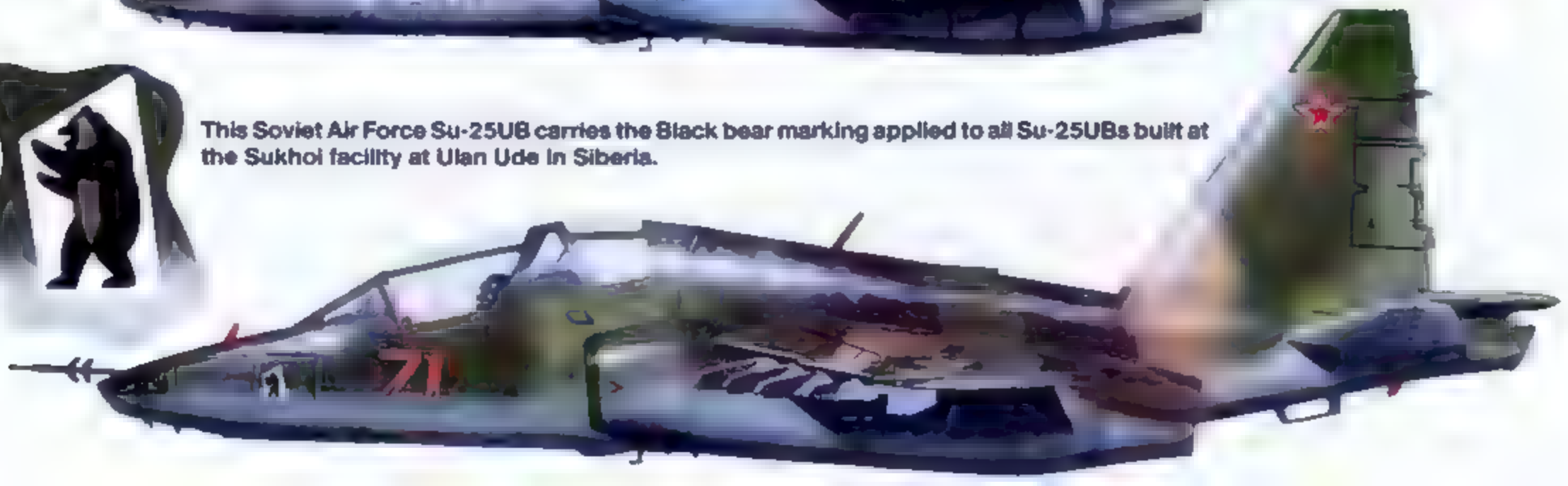
The naval trainer Su-25UTG prototype, Blue 08, was intended to serve as a carrier based trainer. Only one prototype was actually built.



(Some Aircraft)

An Su-25UBK Frogfoot B of the Bulgarian Air Force. Bulgaria operates one regiment of Frogfoot As, although a lack of fuel has grounded most of the force.

This Soviet Air Force Su-25UB carries the Black bear marking applied to all Su-25UBs built at the Sukhoi facility at Ulan Ude in Siberia.



Several Su-25s were badly damaged by Stingers or ground fire, but, even with only one engine operating and most of the instruments and the systems gone, the *Grach* was able to make it back to friendly lines. There were even cases where Su-25s survived hits by AIM-9L Sidewinder air-to-air missiles.

There were a number of Su-25 pilots that flew several hundred combat missions. COL Alexandr Rutskoy flew over 400 missions and was shot down twice, while CAPT Vladislav Gontcharienko flew 415 combat missions, was never shot down and was one of the youngest *Grach* pilots to win the Hero of the Soviet Union award.

One of the greatest *Grach* pilots of the Afghan war was Senior LT Konstantin G. Pavlyukov, who,at the time, was only twenty-three. During a mission in December of 1986, Pavlyukov managed to destroy two Stingers launched against his formation. He shot down the first with a burst from his AO-17A cannon, while the second was shot down by a salvo of unguided rockets. His quick action saved the life of the flight leader, LT A. Potchkin.

His luck finally run out during a mission against a Mujahideen position on 21 January 1987. His *Grach* was hit by a Stinger missile and, although he managed to safely eject, he was wounded by Mujahideen ground fire on the way down. On the ground, he was unable to radio his position to rescue forces and was soon encircled by the Mujahideen. After about an hour of attempting to evade, he killed himself and the approaching Mujahideen with a grenade. Senior LT Pavlyukov was posthumously awarded the Hero of the Soviet Union award.

This Frogfoot A was struck in the rear fuselage by a Stinger infrared homing surface-to-air missile. In most cases Stinger hits were in the engine nacelle area or rear fuselage where the exhaust plume was hottest. (Sukhoi OKB)

This Frogfoot A was hit in the starboard engine by a Stinger surface-to-air missile. The rear engine nacelle and exhaust pipe were totally destroyed and the aircraft returned to base for an emergency landing still carrying a full bomb load and on landing, the main landing gear failed. (Sukhoi OKB)

Even though the port R-95Sh engine of this Frogfoot A was knocked out by a Stinger missile hit, the aircraft was able to return to base thanks to the armor plate installed between the engine bays. Although not shot down by the Stinger, the missile hit did put the aircraft out of action for a considerable time. (Sukhoi OKB)

Su-25K Export Frogfoot A

During the late 1970s, the Soviet Union announced to their Warsaw Pact allies that a new attack aircraft would be soon available to re-equip their tactical regiments. During this time the number of ground attack units within the Pact was growing steadily since the alliance was changing from a purely air defense force to a multi-role force capable of supporting their ground forces.

Initially, the plan laid down by the Soviet Union was to produce the Su-25 at the P.Z.L. factory at Swidnik, Poland, with production scheduled to begin during 1977. This plan, however, fell through when the Polish Air Force rejected the Su-25 in favor of the multi-purpose Su-22M-4 Fitter K. In fact, most of the Warsaw Pact countries (Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland and Romania) were far from enthusiastic about the new attack aircraft.

Most of the military leaders within the Warsaw Pact expressed the feeling that there was no need for a dedicated attack aircraft and that multi-role fighters such as the Su-22M-4 Fitter K would better satisfy their needs (the Su-25 had faced these same comments when the type was first proposed to the Soviet Air Force some ten years before). Despite reports from Vietnam and later Afghanistan which proved the need for a dedicated attack aircraft that could perform highly accurate air strikes in heavily defended areas, the decision not to purchase the *Grach* as the standard Warsaw Pact attack aircraft remained unchanged.

In the event, only two members countries purchased the Frogfoot: Bulgaria and Czechoslovakia. Additional exports were obtained when Iraq and North Korea each purchased the aircraft. While the number of export customers was low the number of aircraft exported was significant. Of the 330 Frogfoot As built at Tbilisi, more than one third was for export to these four countries.

The export variant of the Frogfoot A received the designation Su-25K (*Kommyerzyeskij*, export). These were externally identical to the early Soviet Su-25 but featured a number of internal equipment changes such as downgraded avionics and fire control systems (for Iraq and North Korea). The Su-25Ks delivered to the Warsaw Pact members, Bulgaria and Czechoslovakia, were actually state of the art aircraft nearly identical to Soviet Air Force aircraft.

The Su-25K differed from the Soviet Frogfoot A in that all Su-25Ks carried the three pole Odd Rods IFF antenna as standard, while most Soviet Su-25s were upgraded with the later blade style IFF antenna. Additionally, the surface-to-air missile countermeasures equipment available on the Soviet *Grach* as field modification kits were never exported. As a result, none of the export Su-25Ks carried chaff/flare dispensers on the rear engine nacelles.

Czechoslovakia

The Czechoslovak Socialist Republic became the first non-Soviet country to fly the Frogfoot A. The first four Su-25Ks for the *Ceskoslovenske Letectvo* were delivered by Soviet pilots to Hradec Kralove Air Base on 2 April 1984. These aircraft had the Czech national markings on the wings and vertical stabilizer painted on at the factory, but lacked their four digit tactical numbers which were later painted by Czech ground crews. The tactical numbers employed by the Czech Air Force were the four last digits of the aircraft serial number. The first Czech Su-25K (Serial Number 25 508 105 003) therefore became Black 5003 in squadron service.

The Frogfoot As were allocated to the 30. *Bitevni Letecky Pluk* (30th Attack Regiment) which also had a traditional name, *Ostravsky*, in honor of the city of Ostrava. The unit was formed during the Second World War in the Soviet Union and it was a tradition among Czech and Polish units fighting with the Red Army to name their units after cities in their homelands.

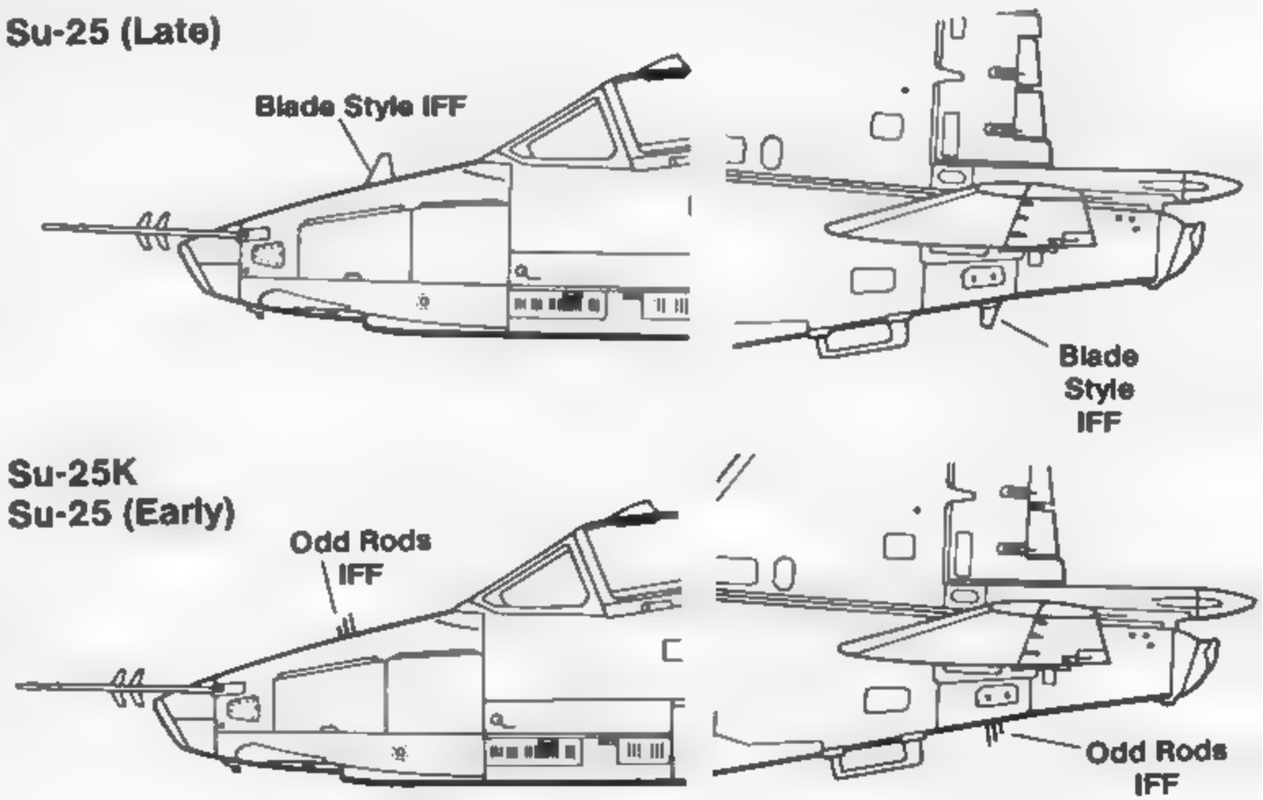
The 30th Attack Regiment was part of the 34th Fighter Bomber Division, under the 10th (Tactical) Air Army. The 34th Fighter Bomber Division also has two Su-22M-4 Fitter K and a single MiG-23BN Flogger F regiments under its command, with each regiment consisting of three squadrons of twelve to fifteen aircraft each.

Each squadron of the 30th Attack Regiment has twelve aircraft on strength for a total of thirty-six of the thirty-eight Su-25Ks delivered (along with two Su-25UBK trainer) The first squadron was staffed by the most experienced pilots who could perform any mission, even under the worst weather conditions. The second squadron was manned by pilots who were considered to be of average skill, while the third squadron had new pilots and trainees and, as a result, was allocated the two Su-25UBK two seat trainers.

On 11 June 1984, MAJ Frantisek Novak became the first Czech pilot to fly an Su-25K when he took off from Hradec Kralove in Black 5007 for a forty minute familiarization flight. During that Summer, the first group of Czech pilot converted to the Su-25K and the new type was introduced to the public during the 1985 May Day parade when a formation of nine Su-25Ks flew over Prague. For more than a year, the communist government had kept the existence of the new ground attack aircraft a well guarded secret.

During the first half of 1985, the unit was transferred from Hradec Kralove to Pardubice, after having been based at Hradec Kralove for over twenty-six years. The first eight aircraft delivered (from production Batch 50) were soon followed by an additional four aircraft from production Batch 60. These twelve aircraft were used to equip the first squadron. The Su-25K quickly earned the nickname "Steam Locomotive" or "Little Locomotive" in Czech service.

IFF Systems



During 1986, another ten Su-25Ks (from Batch 80) were delivered and were assigned to the Second Squadron. All these aircraft took part in the *Druzba 86* (Friendship) exercise held during September of 1986. In the Summer of 1987 another six Frogfoot As (Batch 90) were delivered to finish equipping Second Squadron and start formation of the Third Squadron. These were soon followed by eight Su-25Ks (Batch 100), which were all allocated to the Third Squadron.

All Czech Frogfoot As carry the Central European camouflage scheme of Dark Green, Light Green, Earth Brown and Tan over Light Blue undersurfaces. The Czech national insignia is carried on the top and bottom of the wing and on the vertical stabilizer and is outlined in White. The presentation of the tactical numbers has changed over the years. Initially, these were Black four digit numbers. Since the Black numbers were hard to see against the dark camouflage, they were given thin White outlines during the Summer of 1986.

In the Summer of 1987 (with the delivery of Batch 90 and Batch 100 aircraft) the tactical numbers were changed from Black to White Some aircraft including numbers 8074, 8078, 8079, 8080 and 8081 had been changed earlier, during the Spring of 1986. One Su-25, White 1002, had the tactical number experimentally outlined in Red, although this was not formally adopted for other Su-25s (except the two Su-25UBK trainers).

Initially, the White tactical numbers were in a stencil style but it later became common to repaint the number as a solid White number (on aircraft from Batch 50, Batch 60 and part of Batch 80). Aircraft from Batch 90 and Batch 100 have retained the stencil style White tactical numbers.

It had been a tradition of the *Ostravsky* Regiment during the Second World War to paint the crest of the city of Ostrava on their Il-2s. This tradition became a victim of communist censorship during the 1960s. On 25 August 1988, Engineer Antonin Fidransky attempted to revive the tradition when he painted the crest of Ostrava on a White background on the port air intake of White 6019.

In addition to the crest, Fidransky also painted a sharkmouth marking on the nose and a nude pinup girl with the name *Anca* in White on the port side of the fuselage behind the cockpit. Needless to say, the sharkmouth and nude were ordered removed immediately and *Anca* never flew in these markings It is known that at least two other pinup girls were later painted on White 6019.

This Su-25K, Black 5006 was one of the first batch of four Frogfoot As delivered to the 30th *Bitevni Letecky Pluk* (30th Attack Regiment) on 2 April 1984. The four digit Black tactical numbers were applied after the aircraft were delivered. (A. Timochzy)

There was also a pinup girl painted on White 5006 and, while the pinups were short lived, the crest of Ostrava was readopted as the official unit badge; however, the standard crest is somewhat smaller than the crest applied to White 6019. The 3rd Squadron was the first unit to apply the crest, carrying the marking on port air intake. In September of 1989, during the Mosnov-Ostrava air show, the crest was introduced to the public for the first time on White 1027.

Bulgaria

In 1985, the People's Republic of Bulgaria became the second export customer for the Frogfoot A when the first batch of Su-25Ks were delivered by Soviet ferry pilots to the *Bulgarski Vozdusny Vojskil* at Bezmier Air Base near Jambol in central Bulgaria. The Frogfoot Attack Regiment came under the command of the Military Land Army Cooperation Formation, headquartered at Stara Zagora. The second and final batch of Su-25Ks arrived a year later, giving the Bulgarian Air Force a total of thirty-six aircraft equipping the three squadrons with twelve aircraft each.

Conversion training took part at Bezmier Air Base under Soviet instructors. These instructors were responsible for ground school, theory, flight training and tactical training. When the flight training program began in 1985 there were no Su-25UBK two seat trainers available in Bulgaria and familiarization flights were conducted using MiG-15UTI two seat jet trainers which, according to Bulgarian pilots, had almost the same handling characteristics as the Su-25K. Later, when four SU-25UBKs were delivered to Bulgaria the MiG-15UTIs were withdrawn from the program (the last MiG-15 was retired from Bulgarian service during 1988).

White 5006 carried the pin-up nose art for only a short time as this art work was frowned upon. The White tactical numbers were introduced during the Summer 1987 because the Black numbers had proven too hard to see. The curved canopy support rod was typical of early production Frogfoot A variants. (Pavel Polach)

The Regimental commander, COL Ivan N. Popgeorgijev, was among the first Bulgarian pilots to complete the transition program. During the transition program, one Su-25K was lost. According to GEN Ilja G. Sinapov, the Commander-in-Chief of the Bulgarian Air Force, the two main disadvantages of the Su-25K (from the Bulgarian point of view) are its rather limited range and its extraordinary high fuel consumption.

This latter disadvantage became critical when, on 1 April 1991, the Warsaw Pact ceased to exist as did all the benefits of that alliance. These included the direct support of the Soviet Union in the area of aviation fuels and oil. The drastically reduced fuel imports from the Soviet Union had a crippling effect on military aviation in Bulgaria. As a result, most of the Su-25s have been grounded. Even elite MiG-21bis Fishbed air defense regiments have became a victim of the fuel problems and pilots were forced to "fly" their missions on rudimentary MiG-21 simulators on the ground.

All the Bulgarian Su-25K carry the standard Central European camouflage with the national insignia applied on the lower wing surfaces and on the vertical stabilizer outlined in White. The tactical number is a three digit White number outlined with Light Blue. Some aircraft carry a unit badge on the nose.

Iraq

Iraq became the first export customer of the Su-25K outside the Warsaw Pact when the first Frogfoot As were delivered by sea (in crates) during 1985 for service with the *Al Quwwat al Jawwiya al Iraqiya* (Iraqi Air Force).

The arrival of the Frogfoot in Iraq was not surprising since the Soviet Union had been the most important weapons supplier to President Saddam Hussein during the bitter Iran-Iraq war. Between 1980 and 1988 some fifty-three percent of weapons supplied to Iraq came from the USSR, followed by France who supplied some twenty percent of Iraq's military needs.

An Su-25K, White 5036, of the 1st Squadron, 30th Attack Regiment on the apron at Pardubice. This early Frogfoot A is equipped with a PTB-1150 drop tank on the inboard pylon and an APU-60-1M missile rail for the R-60MK (AA-8 Aphid) missile on the outboard pylon. (SIGN via Roman Sekyrka)

For the Soviet Union it was not only a good deal because desperately needed Western currency could be earned from these shipments, but also because the war with Iran kept Iranian revolutionary ideas from being exported to the predominately Muslim Soviet districts that bordered Iran as well as to the Soviet Republics of Kazakhstan, Azerbaijan and Armenia.

Iraqi pilots were trained by Soviet instructors in Iraq; however, most of these pilots lacked confidence, experience and the right basic training needed to conduct low level ground attack missions. As a result, the Soviet instructors trained them in medium to high altitude strike tactics.

The war with Iran revealed that most close air support missions were flown by attack helicopters, such as the Mi-24 Hind, rather than fixed winged aircraft. As a result the nimble Su-25K saw only limited service during the Iran-Iraq conflict. In combat, even with a five to one advantage over the Iranian Air Force, Iraq never pressed home its advantage and often made glaring operational errors resulting from poor intelligence and tactical reconnaissance.

The standard armament carried by the Frogfoot during the war with Iran was the UB-32A 57MM unguided rocket pod and various free-fall bombs from a number of different countries. It is known that the H-29 (AS-14 Kedge) air-to-surface missile was delivered to Iraq but it is believed it was never used operationally on the Su-25K even though the Frogfoot A was capable of performing strikes with this weapon.

The Su-25K was also reportedly used to deliver 551 and 1102 pound chemical bombs (the 1,102 pound weapons were locally converted BR-500 High Explosive bombs originally produced by EXPAL in Spain). Two different types of chemical weapons were produced in quantity by SEPP (State Enterprise for Pesticide Production) at Samarra, north of Baghdad. One was mustard gas and the other was Tabun, a deadly nerve gas developed in 1936 by Dr. Gerhard Schrader in Germany. The first reports of mustard gas use were given by Iran to the UN Security Council in November of 1983.

There were a total of thirty Su-25Ks delivered to Iraq between 1985 and 1987. These aircraft were assigned to independent formations based at various airfields throughout the country, including Tallil, Jalieah and Bassorah. When the war with Iran came to a halt in 1988, there were about twenty Frogfoot As still in operational service.

An early Su-25K taxies out for a mission at Pardubice, Czechoslovakia. The lack of the anti-glare shield on the wing tip identifies this aircraft as an early production Su-25K. The truck in the background is a TATRA T-148 fuel truck. (SIGN via Roman Sekyrka)

The Iraqi Su-25K was considerably downgraded in internal equipment, especially the fire control computer and avionics. The aircraft were all standard production Frogfoot As with the anti-glare panel on the wingtip and late style cannon muzzle, although all carried the Odd Rods IFF antenna.

The Iraqi Su-25Ks had a very distinctive camouflage pattern used only on Iraqi aircraft. It consisted of Sand, Earth Brown and Olive Drab uppersurfaces over Light Blue undersurfaces. The national insignia was applied on the top and bottom of the wings and on the rear fuselage and a rectangular fin flash was on the tail.

All Iraqi Su-25Ks carried a five digit Arabic tactical number in Black. It is a common Iraqi practice that all Soviet built fighter and fighter-bomber aircraft carry Black five digit tactical numbers with the first two digits being the Soviet export designation of the type. Under this system all Iraqi Frogfoot As have tactical numbers beginning with "25." Servicing instructions on the fuselage and wings, as well some of the cockpit instruments, were labeled in Cyrilic as well as in English

The first public display of the Su-25K in Iraq took place in May of 1989 when an Aviation Day air show and display was organized at Saddam Hussein International Airport in Baghdad. This display was open to the press and among the combat aircraft on display was an Su-25K, Black 25590.

During Operation DESERT STORM, Iraqi Su-25K played only a minor role Coalition forces destroyed most of the Iraqi communications network, making it impossible to direct the Su-25K forces in any sort of attack against Allied troop concentrations. Allied air superiority made it very difficult for the Iraqi Air Force to operate without being destroyed and for this reason, most of Saddam Hussein's Su-25Ks remained on the ground. The Frogfoot force was dispersed to a number of various airfields and despite the availability of hardened shelters, a number of aircraft were parked in the open and at least one Su-25K, Black 25591, was destroyed on the ground at Jalieah Air Base.

On Friday, 25 January 1991, the first seven Iraqi Air Force aircraft landed in the neighboring Islamic Republic of Iran. As the number of aircraft defecting to Iran grew, the USAF set up Combat Air Patrols (CAPs) over north-eastern Iraq with the aim of blocking Iraqi air assets from reaching the safety of Iran.

At first these defections were done on an individual basis, as evidenced by the mixed assortment of aircraft arriving at different Iranian airfields. Later, it was more organized and definitely sponsored by the Iraqi Air Force. It was hoped that, by sending aircraft to Iran, when the war ended (with or without Saddam Hussein) some semblance of an air force would remain. Most of the defectors landed at the Iranian bases of Tabriz, Hamadan-Shahrokhi and Dezful-Vahdati.

On 6 February 1991, shortly after sunrise, two MiG-21s and two Su-25Ks took off from their bases and headed for the Islamic Republic of Iran. The Iraqi aircraft were intercepted by the USAF CAP, two F-15Cs of the 36th TFW, 53rd TFS flown by CAPT Thomas N. Dietz (79-0078) and his wingman 1LT Robert Hehemann (84-0019). While the flight leader engaged and destroyed the two Fishbeds (0845 local time), 1LT Hehemann rolled in and fired two AIM-9 Sidewinder air-to-air missiles against the fleeing Frogfoot As Both missiles found their intended targets and the two Su-25Ks crashed in the desert short of the Iranian border.

After the Gulf War, on 12 April 1991, the Iraqi Foreign Minister Ahmad Hussein Khuddayer Al-Sammaraei announced that 148 aircraft had flown to Iran. 115 combat aircraft and thirty-three airliners. This figure includes seven Su-25K Frogfoot As. Teheran stated that the aircraft would only be returned to Iraqi if the Irqai government paid all the claimed reparations owed Iran (nine billion US dollars) from the Iran/Iraq war. During late April 1991, it was reported that the Iranians were applying their national insignia to these aircraft, indicating that they have no further intentions of returning the aircraft to Saddam Hussein.

A lineup of four early production Su-25Ks, White 5040, White 6018, White 6017 and White 8019 of the 1st Squadron, 30th Attack Regiment, Czech Air Force. The aircraft in the foreground, White 5040, is equipped with APU-68-UM2 rails on pylons two and four to carry the S-240 unguided air-to-ground rockets which are on the trolleys next to the aircraft. (Pavel Polach)

An Su-25K, White 6018, of the 1st Squadron, 30th Attack Regiment on the ramp at Pardubice Air Base. The aircraft is armed with UB-32A rocket pods and an MBD-3 multiple bomb rack capable of carrying four 220 pound bombs on the number four pylon. The fuel truck in the background is a TATRA T-148 fuel truck. (Pavel Polach)

North Korea

The last country to receive the Su-25K was the Democratic Peoples Republic of Korea (North Korea). Soviet ties to this country were greatly improved after President Kim Il Song's May 1984 and October 1988 visits to Moscow. These visits resulted in dramatic changes in Pyongyang's foreign policy, which began to take on a definite pro-Soviet slant. The change in policy also led to increased Soviet military assistance In exchange for expanded cooperation in intelligence-collection activities and permission for Soviet aircraft to overfly North Korea for missions over the Yellow Sea, a number of new aircraft were delivered to the North Korean Air Force including MiG-23s and Su-25s.

North Korea had experience with the Il-10 aircraft which saw considerable combat with the NKAF during the Korean conflict and, in contrast to most Warsaw Pact members, the value of an attack aircraft for close air support was appreciated within the North Korean Air Force.

A first batch of six aircraft were delivered during 1988. These were followed by additional Frogfoot As with the NKAF operational strength reaching some thirty-six Su-25Ks, all of which were assigned to a single three squadron ground attack regiment.

These aircraft are all housed in hangars carved into mountainsides with reinforced blast doors which protect the aircraft from both conventional and nuclear weapons The only way to put them out of action is to destroy the aprons, taxiways and runways. A similar tactic was used against Iraqi bases during Operation DESERT STORM and proved to be most effective for rendering a force useless for extended periods of time.

The artwork on White 6019 was done by Antonin Fidransky. At the time he painted *Anca* on the side of the aircraft, the communists were still in power and this kind of artwork was something totally unknown in Warsaw Pact units and not officially allowed. (Pavel Polach)

This sharkmouthed Su-25K Frogfoot A, White 6019, carried the name *Anca* in White on the fuselage side and a nude pinup girl. The sharkmouth, name and girl lasted only a few hours before it was ordered removed on 25 August 1988. (Pavel Polach)

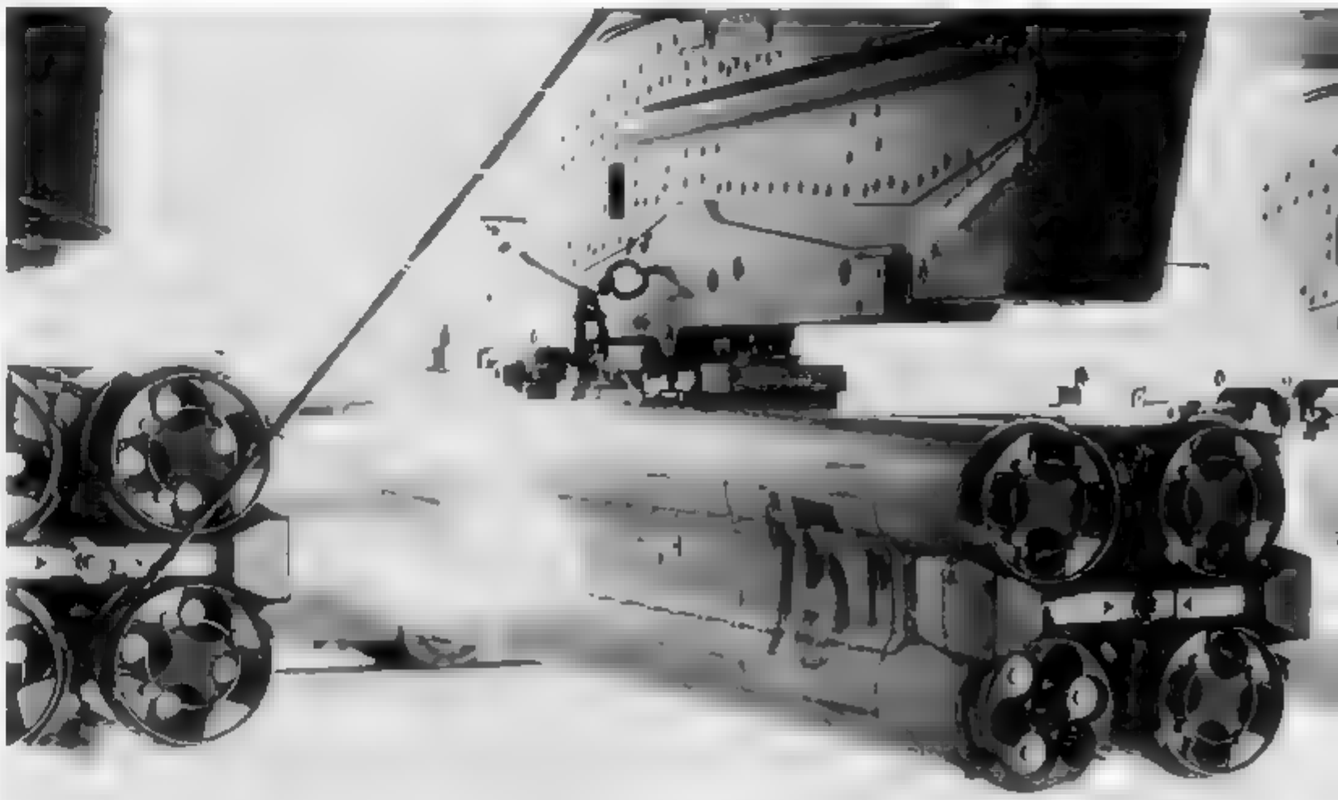
The Su-25K, White 5008, was among the first Frogfoot As delivered to Czechoslovakia. The covers on the air data probes and blade IFF antenna are in Red. The fairings on top of the canopy is a rear view mirror. (Pavel Polach)

Later, White 6019 carried an outline of another nude pinup on the fuselage in White. As far as is known, this was never painted in. (Pavel Polach)

This early Su-25K has the air data sensors and laser range finder/designator window covered by Red protective covers. The RM-122 four tube rocket launchers on pylons one, two and three are for S-13 unguided air-to-ground rockets. (Antonin Fidransky)

White 6019 has carried at least three different forms of nose art, including this White nude. All were in the same location on the fuselage and none lasted for a long time. The Frogfoot A is equipped with PTB-1150 drop tanks and an MBD-3 bomb rack with four FAB 100, 220 pound bombs. (Pavel Polach)

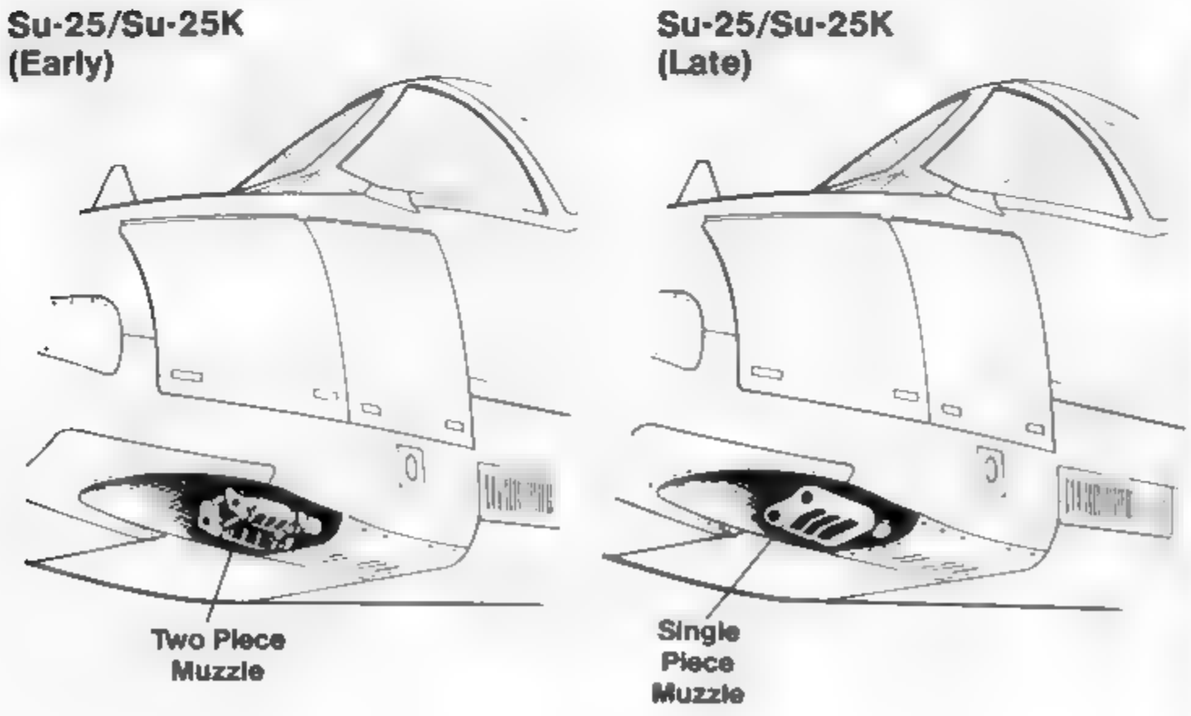
These RM-122 four shot rocket tubes accommodate four S-13 unguided air-to-ground rockets and are carried as an alternative to the B-8M1 twenty-shot rocket pod which holds twenty S-8 rockets. These four shot tubes are not normally carried by Su-25Ks, being used more often on light attack aircraft such as helicopter gunships. (Antonin Fidransky)



The Su-25K, White 6020, was the last Frogfoot A of production Batch 60 to be delivered to the Czech Air Force. The aircraft was assigned to the 1st Squadron, while the Su-25UBK two seat trainer, White 3348, was assigned to the 3rd Squadron. White 6020 carries an APU-68-UM2 rail for a S-24 240mm rocket on number three pylon and an APU-60-1M R-60MK AAM rail on the outboard pylon. (SIGMA via Roman Sekyrka)

Early Su-25s and Su-25Ks had a two pieced muzzle on the AO-17A twin barrelled 30mm cannon. The gun was offset to port with the ammunition supply (250 rounds) on the starboard side. This Czech Su-25K, White 6019, also has an SPPU-22 twin barrelled 23mm cannon pod on the number two pylon. The pod contains a GSh-23 cannon and 260 rounds of ammunition. (Pavel Polach)

Cannon Muzzle



This late production Czech Air Force Su-25K, White 1003, is equipped with the later style one piece cannon muzzle. The natural metal panel in front of the gun port is a blast panel to prevent damage to the aircraft skin from the muzzle blast of the cannon. (Otakar Saffek)

This Su-25K, White 1007, of the 3rd Squadron undergoes maintenance on the ramp at Pardubice. The equipment box, tow bar and fire extinguisher all carry the tactical number of the aircraft assigned to this parking spot, White 9099. White 1007 has the cannon ammunition bay hatch open as are several of the port engine bay hatches. (SIGN via Roman Sekyrka)

This Su-25K, White 1004, carries the standard presentation of the Crest of Ostrava on the air intake. This aircraft was delivered during the Summer 1987 and was assigned to the 3rd Squadron of the 30th Attack Regiment. The last two digits of the tactical number are repeated in White on the Red air intake cover. (SIGN via Roman Sekyrka)

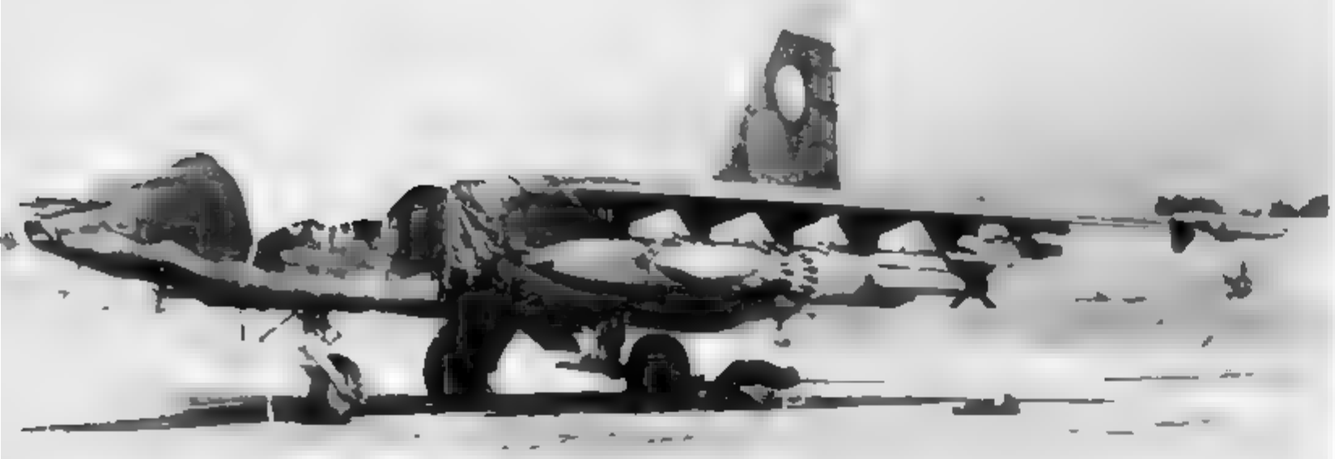
External power cords are attached to the external power outlets on this Su-25K, White 1027, of the Czech Air Force. The pilot's boarding ladder was fully retractable, folding up into the bay in the side of the fuselage. The aircraft carries the late style crest of Ostrava which has no White outline. (Jaromir Stepan/ZLINEK Magazine)

The nosewheel on White 1088 collapsed while the aircraft was parked on the ramp at Pardubice. The TATRA T 815 mobile crane in the background will be used to hoisted the aircraft so that ground crewmen can lower the nosewheel and install the safety pins. (Pavel Polach)

Three Frogfoot As on the flight line of the 2nd Squadron, 30th Attack Regiment at Pardubice. White 8077, in the foreground, has a solid White tactical number while White 8078, in the background, has a White stencil style tactical number. (SIGN via Roman Sekyrka)

An Su-25K, White 8073, is refueled prior to a training mission while the ground crew relax by the aircraft. This aircraft carries PTB-1500 fuel tanks and six UB-32A thirty-two shot 57мм air-to-ground rocket pods. (Pavel Polach)

This Su-25K has the air intakes and canopy covered with protective canvas covers. It is armed with an SPPU-22 twin GSh-23 23мм trainable cannon pod on the number two pylon, a B-8M1 twenty-shot rocket pod on the number three pylon and an S-24 240мм unguided air-to-ground rocket on the number four pylon. (Pavel Polach)



An Su-25K, White 9093, rolls out at Pardubice with the flaps lowered and the speed brakes closed. This aircraft belongs to the 3rd Squadron, 30th Attack Regiment, and was delivered in the Summer of 1987. The tactical number is in the later stencil style. (SIGN via Roman Sekyrka)

This Czech Air Force Frogfoot A was given a special paint scheme for its visit to the International Air Tatoo at Boscombe Down, England during June of 1992. The color scheme was a direct takeoff of the aircraft's NATO reporting Name — Frogfoot. (Glenn Ashley)

White 9013 was attached to the 2nd Squadron, 30th Attack Regiment at Pardubice. The tactical number was displayed as a White outline only against the "camouflage" finish. The aircraft took part in the flight displays at Boscombe Down on both 13 and 14 June 1992. (Simon Watson)

The Czech Su-25K carried a unique marking on the tail. The Frog holds what appears to be a Soviet T-34 type tank in its hand, not a NATO or western type tank. The Czech national marking was carried on the rudder in a much smaller size than normally applied to Czech Su-25Ks. (Simon Watson)

A Bulgarian Air Force Su-25K, White 103, on the ramp at Bezmier Air Base in central Bulgaria. This Frogfoot A carries no ordnance, but is equipped with the usual PTB-1150 fuel tank. The national markings were applied on the lower wing surfaces and on the stabilizer. (Wojciech Luczak)

This Iraqi Air Force Su-25K, Black 25590, was put on public display during May of 1989 at the International Air Display held at Saddam Hussein International Airport, outside Baghdad. Iraqi Su-25Ks have a desert camouflage of Sand, Earth Brown and Olive Drab uppersurfaces over Light Blue undersurfaces. (Christopher Foss via Steven Zaloga)

The regimental emblem, a Yellow lion surrounded by a White outline shield with a Red star, was carried on a number of Bulgarian Air Force Su-25Ks. All Bulgarian Air Force Frogfoot As had three digit White tactical numbers with a thin Blue outline. (Simon Watson)

This Iraqi Su-25K, Black 25591, was destroyed on the ground by an allied air attack at Jalleah airfield. The aircraft was completely burned out aft of the cockpit, while the armored cockpit section remained more or less intact. At least seven Iraqi Frogfoot As were flown to Iran where they were taken over by the Islamic Republic of Iran Air Force. (Dick Cole)

The Head Up Display (HUD) of a Czech Air Force Su-25K Frogfoot A is mounted directly behind the armor glass windshield. Reportedly, aircraft exported to Iraq and North Korea were not equipped with the same fire control system as Warsaw Pact Su-25Ks. (SIGN via Roman Sekyrka)

The cockpit layout of the Frogfoot is similar to that of the Sukhoi Su-22M-4 Fitter K. The starboard main console is Gray/Green with White toggle switches and Black knobs. The emergency canopy jettison handle at the upper right is in Red. (Josef Simon/ZLINEK Magazine)

The main panel instrument panel of the Su-25K has all instrumentation and labels in Cyrillic. The panel is painted in a light Gray/Green, the instruments are Black, while the HUD frame is Gloss Black. (Josef Simon/Zlinek magazine)

The port main console of the Su-25K contains the throttles for the R-95Sh engines and oxygen controls. Soviet fighter and fighter-bombers (both MiG and Sukhoi designs) all have a similar cockpit layout, making transition training from one type to the other much easier. (Josef Simon/ZLINEK Magazine)

Su-25UB Frogfoot B

The Su-25UB (UB, *Uchebny Boyevoi*, Combat Trainer) was a two seat trainer developed from the Frogfoot A to meet a Soviet Air Force requirement for a combat capable transition trainer. Prior to the development of the two seat trainer, Su-25 pilots conducted their transition training in the Czech built Aero L-39 Albatros, with two to four L-39s being allocated to each Su-25 regiment.

Development of the two seat variant began during 1985, some eight years after the single seat Frogfoot A. The long period between the introduction of the single seat and two seat variants was not unusual in the Soviet Union, although this sharply differs with Western methods where the trainer is usually available at the same time as the single seat aircraft.

Two prototypes, designated the T-8-UB1 and T-8-UB2, were built during 1985 at Tbilisi, both being converted from standard Frogfoot A airframes. When these aircraft successfully passed their factory tests, they were flown to Zhukovski Test Center some thirty-five miles southeast of Moscow for State Acceptance with the Flight Research Institute. Once these tests were completed, the T-8-UB1 And T-8-UB2 were flown to the Air Force Science and Experimental Institute for field trials.

In 1987, the two seat variant of the *Grach* was cleared for production under the designation Su-25UB and production of the aircraft began that same year at Ulan Ude in Siberia The first prototype T-8-UB1, coded Blue 201, served as the pattern aircraft and was flown to Ulan Ude. During this period a Black bear outlined in White was carried on the aircraft and this insignia was later adopted as the factory badge for all Su-25UBs built at Ulan Ude.

The production Su-25UB differed from the T-8-UB1 (which was basically an early production Su-25 with a second cockpit) in having a different muzzle for the AO-17A cannon and non-standard wing pylons. When the type was observed by NATO it was given the ASCC reporting name Frogfoot B

The Su-25UB trainer is equipped with the same avionics and fire control system as the single seat Frogfoot A. It is fully combat capable and can deliver the same types of ordnance as the single seat Su-25 The second cockpit on the Su-25UB is raised to give the pilot a better forward view. This resulted in a deeper forward fuselage contour The front cockpit has the external rear view mirror deleted and an additional canopy frame on top of the canopy. The rear instructor's canopy has a forward vision periscope, which is a common fitting on Soviet two seat combat trainers.

The two cockpits, each with their own individual pressure systems, were separated by an armor glass screen installed between the cockpits This was done to ensure that a loss of cabin pressure in one cockpit would not lead to a loss of pressure in the second. The front cockpit controls are automatically disconnected whenever the instructor in the rear cockpit takes control.

The built in pilot boarding ladder found on the port side of the Su-25 was deleted on the Su-25UB making it necessary to use an auxiliary ladder. Additionally, the two seat trainer has an antenna on the lower fuselage behind the angle of attack sensor that is not found on the single seater.

To preserve stability, the vertical tail surfaces were enlarged. The T-shaped antenna found on the fuselage spine of the Frogfoot A was replaced by an I-shaped antenna The intake on the starboard side of the fuselage on the Su-25 was deleted on the trainer, the large ram air intake at the base of the vertical stabilizer was reduced in size and the small air intake on the port fuselage spine was repositioned to the rear.

An air intake was added to the rear portion of the engine nacelle which has not been fitted to any Su-25 single seat version. Early production Su-25UBs were equipped with three pole Odd Rods IFF antennas on top of the nose in front of the canopy and on the lower rear fuselage below the tail These have since been replaced on most Su-25UBs with the blade styled IFF antenna.

Su-25UBs are equipped with four piece speed brakes and the anti-glare panel on the wingtip. Late versions are equipped with the fairing on top of the wingtip in front of the speed brake in the same fashion as Soviet Su-25 Frogfoot As. This fairing was only introduced on Soviet trainers, not on export Su-25UBKs.

The Frogfoot B prototype (T-8-UB1, Blue 201) was converted from a standard Frogfoot A single seat aircraft. The aircraft is armed with two R-60 (AA-8 Aphid) air-to-air missiles on the outboard pylon. This prototype later served as the pattern aircraft for the production Su-25UB. (Sukhoi OKB)

This early Su-25UB, Red 97, is equipped with an Odd Rods IFF antenna. Late production Su-25UBs were all fitted with the blade style IFF antenna which was retrofitted to early production aircraft. The aircraft is armed with an H-25ML (AS-10 Karen) air-to-surface missile on the number three pylon. (Yefim Gordon)

The Soviet Su-25UB Frogfoot B was also fitted with the ASO-2V chaff/flare dispenser on top of the rear portion of the engine nacelle. Late batches were configured with the dispensers on the production line, while earlier models were modified with kits as a field modification. These chaff/flare dispensers were only used on Soviet trainers and were never introduced on export Su-25UBKs.

Most Su-25UBs left the factory in the Asian camouflage scheme of Sand, Earth Brown and Olive Drab over Light Blue, although a few Su-25UBs were delivered in the Central European camouflage scheme of Dark Green, Light Green, Earth Brown and Tan over Light Blue. Late production Su-25UBs had a Red air intake warning triangle on the air intakes.

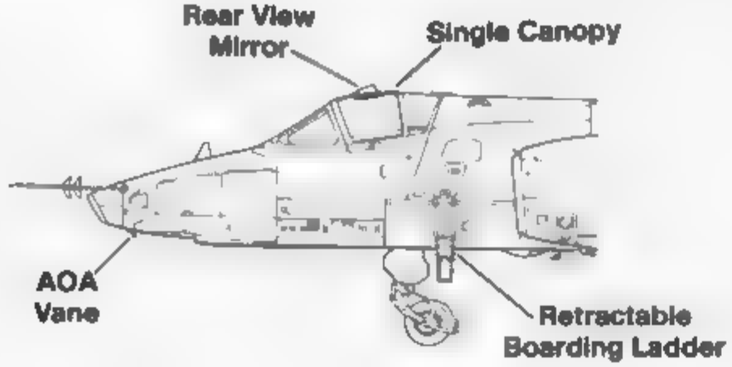
Su-25UB production was insufficient to equip all five Frogfoot regiments with enough trainers and, as a result, there were usually a number of Aero L-39 Albatros trainers attached to each regiment for proficiency flights, navigational training and other duties.

The shortage of Su-25UB trainers was the reason that the two Su-25 units stationed in the German Democratic Republic shared their two Su-25UBs, Red 50 and Red 71, moving them from one regiment to the other whenever there was a need. Additionally, the 368th ShAP at Demmin-Tutow also operated a number of Czech built L-39 Albatros trainers so that the two Su-25UBs were mainly used by the 357th ShAP at Brandis. When the 357th ShAP departed Germany, the Su-25UBs were reasigned to the 368th ShAP.

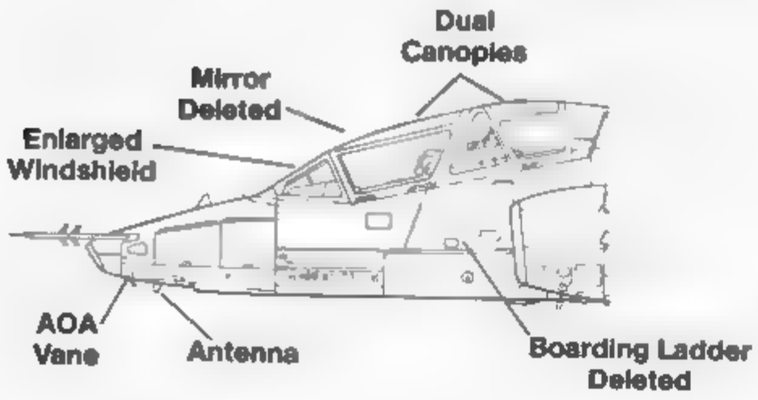
Production of the Su-25UB was closed out at Ulan Ude in December of 1991 when it became clear that the Frogfoot B would not replace the L-39 as the standard advanced jet trainer for the Soviet Air Force.

Nose Development

Su-25 Frogfoot A



Su-25UB Frogfoot B



Su-25UBK Export Frogfoot B

The Su-25UBK (UBK, *Uchebny Boyevoi Kommyerzyeskij*, Export Combat Trainer) was basically the export version of the standard Soviet Su-25UB Frogfoot B. Externally these aircraft were identical, although those exported to non-Warsaw pact countries had downgraded fire control computers and avionics systems.

All Su-25UBKs delivered to Bulgaria, Czechoslovakia and Iraq carried the Asian camouflage scheme and, even though they were built alongside the Soviet Su-25UB at the State Aircraft Factory at Ulan Ude in Siberia, none carried the factory Black bear insignia.

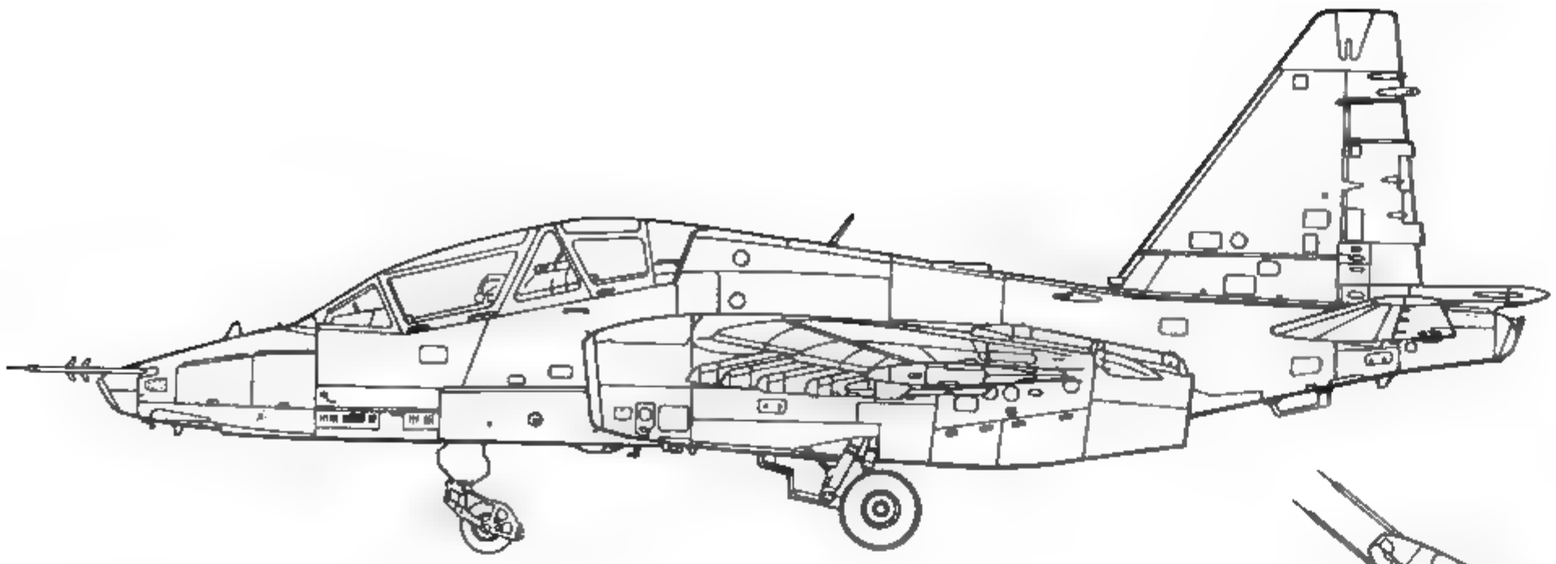
Czechoslovakia received two Su-25UBKs which were assigned to the 3rd Squadron of the 30th Attack Regiment at Pardubice. These aircraft were given the tactical numbers White 3237 and White 3348 with the numbers having a thin Red outline. Similar to Czech Frogfoot As, the crest of Ostrava was carried on the port air intake.

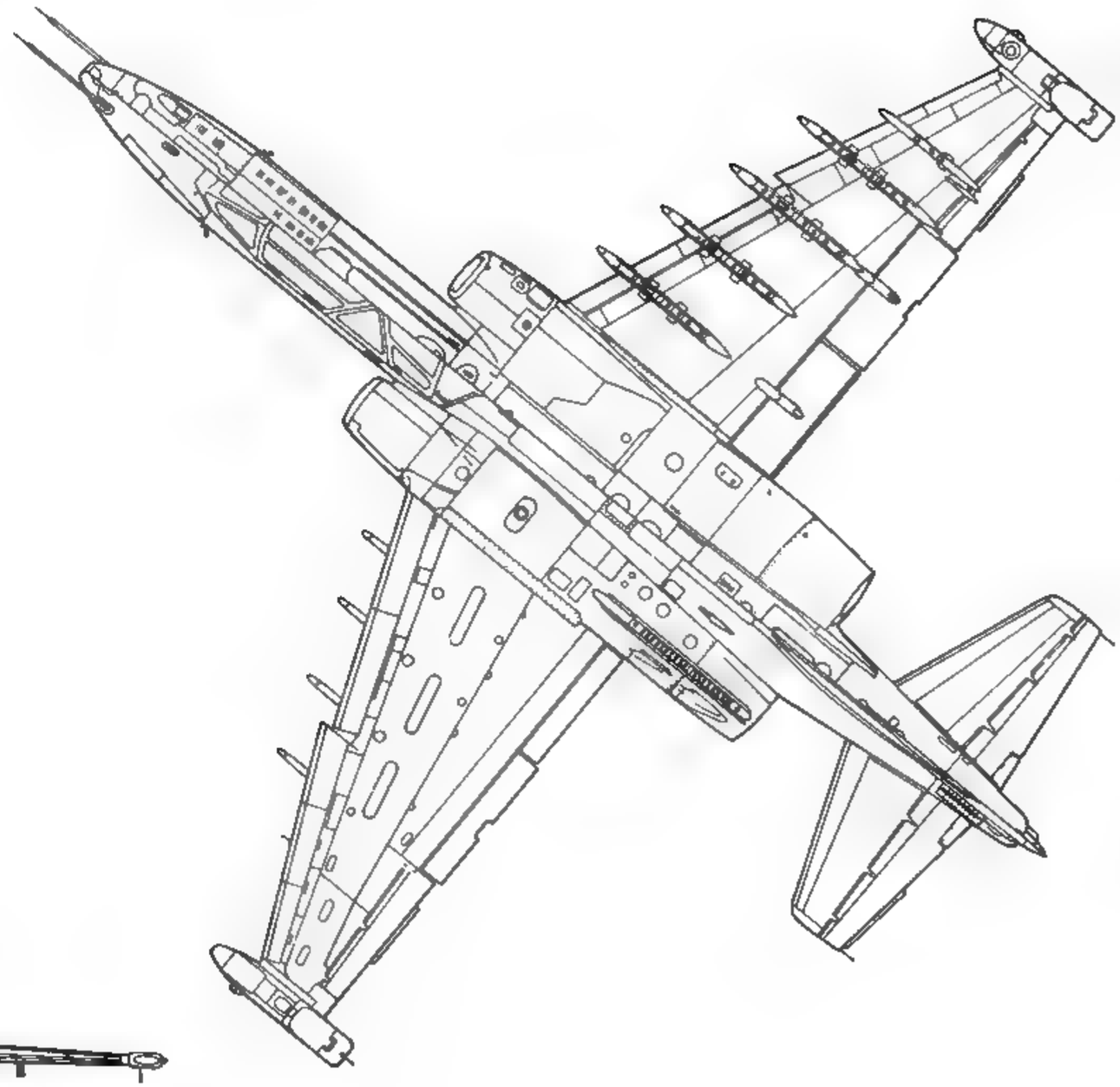
A total of four Su-25UBK were delivered to the Bulgarian Air Force at Bezmier Air Base near Jambol in central Bulgaria, replacing the MiG-15UTI in the training role. The Bulgarian Su-25UBKs carry three digit White tactical numbers which have a thin Blue outline.

The Iraqi Air Force received an unspecified number of Su-25UBKs, although the total is believed to be between two and four. These aircraft have downgraded avionics and fire control systems and carry Black five digit arabic style tactical numbers on the nose.

North Korea also received an unknown number of Su-25UBKs, believed to be two to four, for conversion training during 1988.

A recently completed Su-25UB, Red 07, parked on the ramp of the Sukhoi facility at Ulan Ude. The aircraft is configured for a ferry flight with four PTB-1150 drop tanks. The Black bear insignia on the nose is a factory emblem, not a unit badge, and is carried on the port side only. (Victor Kulikov)





Specifications

Su-25UB Frogfoot B

Wingspan .....47 feet 1.5 inches
Length .....50 feet 11.5 inches
Height .....17 feet .25 inches
Empty Weight .....29,100 pounds
Maximum Weight .....38,800 pounds
Powerplant.....Two 8,820 lbst Tumansky R-195 turbojet engines.

Armament.....One AO-17 30мм cannon and ten underwing pylons for up to 9,700 pounds of ordnance.

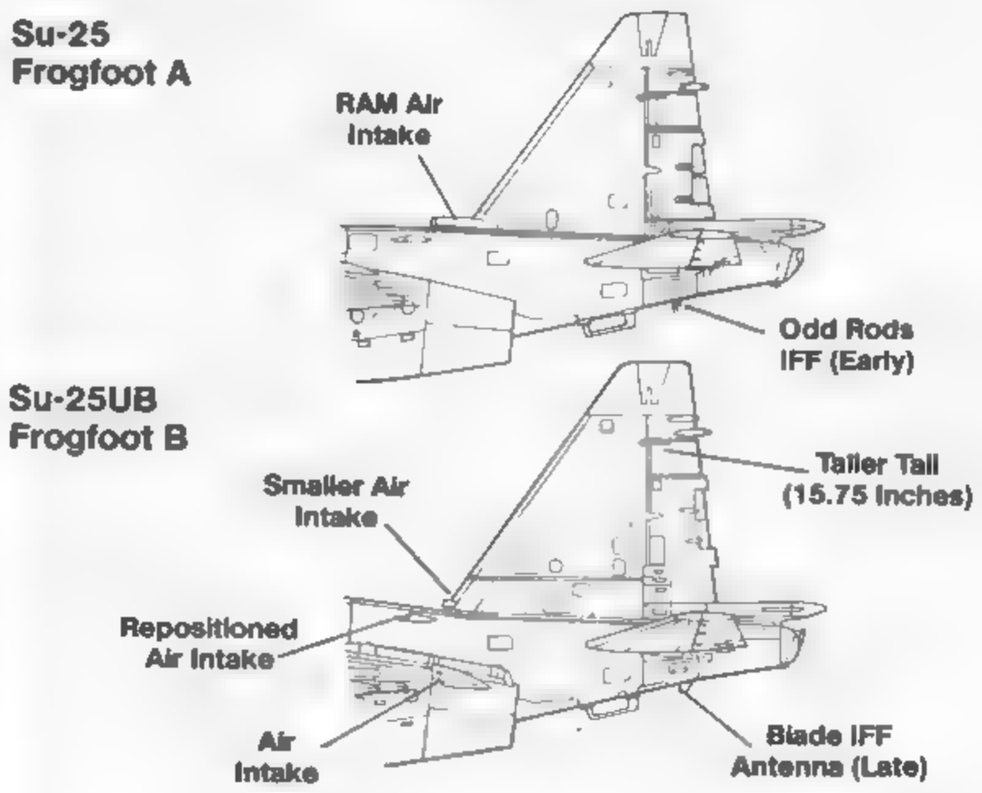
Performance
Maximum Speed .....606 mph
Service ceiling .....22,965 feet
Range.....1,212 miles
Crew .....Two

This early production Su-25UB Frogfoot B, Red 96, carries the early style three pole Odd Rods IFF antennas on the nose and under the tail. The wingtips of this trainer are painted White. (A.A. Zirnov)

This late production Su-25UB, Red 99, on the ramp at Ulan Ude has factory installed ASO-2V chaff/flare dispensers on the upper rear engine nacelle and the later blade style IFF antennas on the nose and under the tail. One of the difference between the Su-25 and Su-25UB was the taller vertical stabilizer on the Frogfoot B. (Victor Kulikov)

Red 50, an Su-25UB, on final approach to Demmin-Tutow Air Base, Germany, with the rear cockpit periscope raised. This Frogfoot B had been modified with the two chaff/flare dispensers on the upper rear engine nacelle. Additionally, the aircraft is carrying an APU-60-1M missile rail on the outboard wing pylon. (Jens Schymura)

Tail Development



A Czech Air Force Su-25UBK, White 3237, on the ramp at Pardubice. The aircraft is in the standard ferry configuration with four PTB-1150 fuel tanks. The city crest of Pardubice is carried on the port air intake only. (Martin Baumann)

An instructor and student taxi out in White 3348, a Czech Su-25UBK for a training mission from Pardubice air base. The two Su-25UBKs on strength with the Czech Air Force are assigned to the 3rd Squadron, 30th Attack Regiment which is responsible for pilot training. (SIGN via Roman Sekyrka)

White 3348 is refueled and serviced on the apron at Pardubice. The aircraft is configured with APU-68-UM2 missile rails on the number two and three pylons. The Su-25UBK is fully combat capable and can carry the same weapons as the single seat Su-25K. (Pavel Polach)

This Bulgarian Su-25UBK, White 002, was one of four Frogfoot Bs purchased by Bulgaria for pilot training. The tactical number, 002, is White with a thin Blue outline. This is an early production SU-25UBK with the early three pole Odd Rods IFF antenna in front of the canopy. (Wojciech Luczak)

Su-28/Su-25UT Advanced Trainer

During 1985, the Soviet President Gorbachev announced his intention to cut defense spending and as a result the production of military aircraft began a steady decline. For the traditional manufacturer of military equipment, such as Sukhoi, this meant that a change in the company's production strategy had to be made to assure its survival in the post cold war period

In order to enter the civilian sector, Sukhoi decided to develop an unarmed variant of the Su-25UB to fill the advanced jet trainer role Additionally, the company began a lobby program to convince Soviet leaders that the Czech built L-29 and L-39 trainers should be replaced by a trainer produced in the Soviet Union.

The new advanced trainer was basically an unarmed Su-25UB with the cannon, armor, fire control system, ECM systems and all other combat equipment deleted, resulting in a weight reduction of more than 4,400 pounds.

The prototype was a converted Su-25UB airframe which flew for the first time from Ulan Ude on 6 August 1985. Originally the prototype was given the designation Su-28, although this was subsequently changed to Su-25UT.

The Su-25UT had the cannon deleted and the muzzle opening faired over, as was the window for the laser designator. The five underwing pylons were deleted, although there were provisions for mounting two pylons under each wing for fuel tanks The wingtip anti-glare panel was removed as were the round antennas on the top and bottom of the wingtip pod.

The ventral Towel Rail HF antenna on the underside of the fuselage in front of the IFF antenna was deleted as were all radar warning button antennas The chaff/flare dispensers on the upper fuselage alongside the vertical stabilizer were also deleted and faired over.

Trials with the Su-25UT prototype, coded Red 07, revealed that its performance and handling characteristics were much better than the Aero L-29 and L-39 For this reason it was also considered as a possible sport aircraft for civil pilots One aircraft, given the civil designation Su-28, was handed over to the para-military Voluntary Society for the Support of the Army, Aviation and Fleet (DOSAAF). This aircraft carried Soviet Air Force markings with the legend DOSAAF carried in Black on the vertical stabilizer During the 1988 DOSAAF aerobatic championships, Sukhoi test pilot Yefgeny I. Frolov captured third place in the competition behind two L-39 Albatros trainers.

The Su-25UT prototype was also chosen to participate in the 38th Aero Salon at Paris held between 8 and 18 June 1989 at Le Bourget Field For the exhibition, two nose electronics probes were installed for the electronics that allowed the Su-25UT to fly on western airways. In addition, an extra air pressure sensor was installed on top of the starboard engine air intake The tactical number, Red 07, was changed to Blue 302, which was the participation number assigned to the Su-25UT at the Aero Salon and the DOSAAF logo was over painted.

Although there are substantial differences between the Su-25UB and Su-25UT, NATO did not assign it a new reporting name and the aircraft is known to NATO as the Frogfoot B The economic situation in the Soviet Union has led to a decision not to build the aircraft, since it was felt that the L-29 and L-39 were still adequate for the advanced trainer role.

The Su-25UT was flown by the DOSAAF and carried their logo on the tail in Black. The aircraft was praised by DOSAAF pilots for its ease of handling and they reported that it had superior performance to the L-29 and L-39 trainers already in service. (Yefim Gordon)

This Su-25UT civil trainer carried the tactical number Blue 302 for its visit to the 1989 Paris Air Show at Le Bourget. The aircraft carried the Sukhoi company logo on the nose in Blue and White. The aircraft spine (originally White) was repainted in Glossy Marine Blue with a White antenna fairing for the show. (John Martin)

Su-25UTG Frogfoot B Naval Jet Trainer

When the first true Soviet aircraft carrier, the TBILISI, was launched on 5 December 1985 at the Nikolayev South Shipyard near Sevastopol on the Black Sea, the Soviet Navy began looking for a suitable carrier based training aircraft.

The only jet trainer available to the Soviet Navy which could economically be converted to fill the carrier trainer role was the Su-25UT. The aircraft was a proven design and rugged enough to withstand the stress of carrier operations. With this in mind, Sukhoi began development work on the new training aircraft during 1987.

A prototype naval trainer was built at Ulan Ude, being converted from the Su-25UT with certain areas of the airframe being strengthened for carrier operations The braking parachute and its container were deleted since the aircraft had an arrestor hook mounted under the strengthened rear fuselage This feature led to the aircraft's designation, Su-25UTG (the G stands for *Gak* or Hook).

The Su-25UTG prototype rolled out in a three tone camouflage of Sea Blue, Light Blue/Gray and Light Blue uppersurfaces over Light Blue undersurfaces, with the tactical number, Blue 08, being carried on the nose with a thin White outline The Su-25UTG also carried the Sukhoi factory emblem on the port side of the nose.

The Su-25UTG was to be used to familiarize Navy pilots with carrier procedures before they converted to the actual combat aircraft which would make up the air wing aboard TBILISI class carriers The first trials of the prototype began during 1987 at Saki naval air base on the Creimean Peninsula For training, a dummy carrier deck was marked out on the runway at Saki with a ski-jump ramp at the front and arresting wires fitted to the rear of the landing area.

On 21 November 1989, the first deck trials of carrier based conventional take off and landing aircraft took place aboard TBILISI. Three different aircraft types (the MiG-29K, the naval Su-27 (T-10-24) and the Su-25UTG) were recovered and launched from the ship during the trials. The Frogfoot, flown by Igor V. Botintsev and Aleksandr V Krutov, was the last aircraft to land and also the last to depart from the deck of the TBILISI.

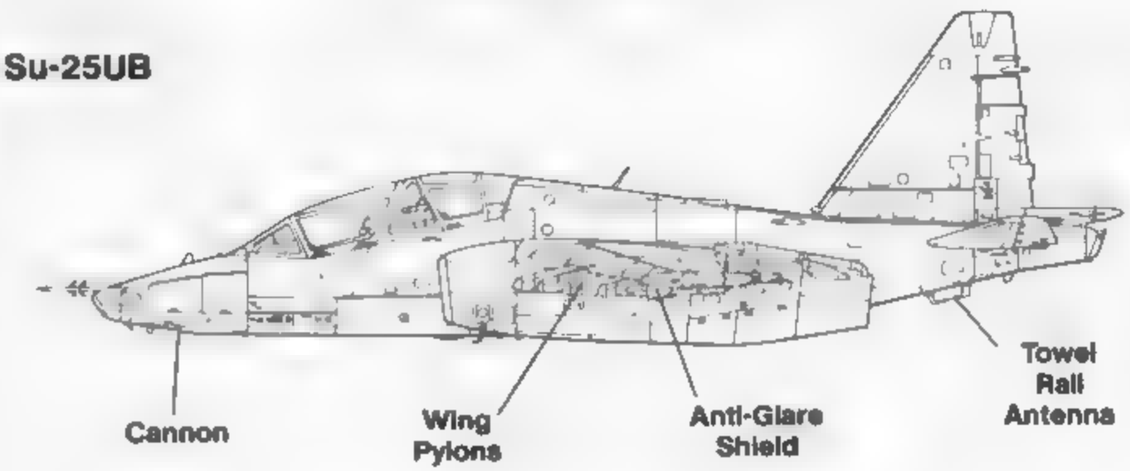
Additional trials were undertaken with Igor V. Botintsev being responsible for Sukhoi factory tests and Aleksandr V. Krutov, a Flight Research Institute test pilot, being responsible for the state acceptance trials. In the event, cuts in the defense budget led to a cancellation of the project and only one Su-25UTG prototype was ever built

The Su-25UTG taxies out for a test flight with the rear seat periscope in the raised position. (Sukhoi OKB)

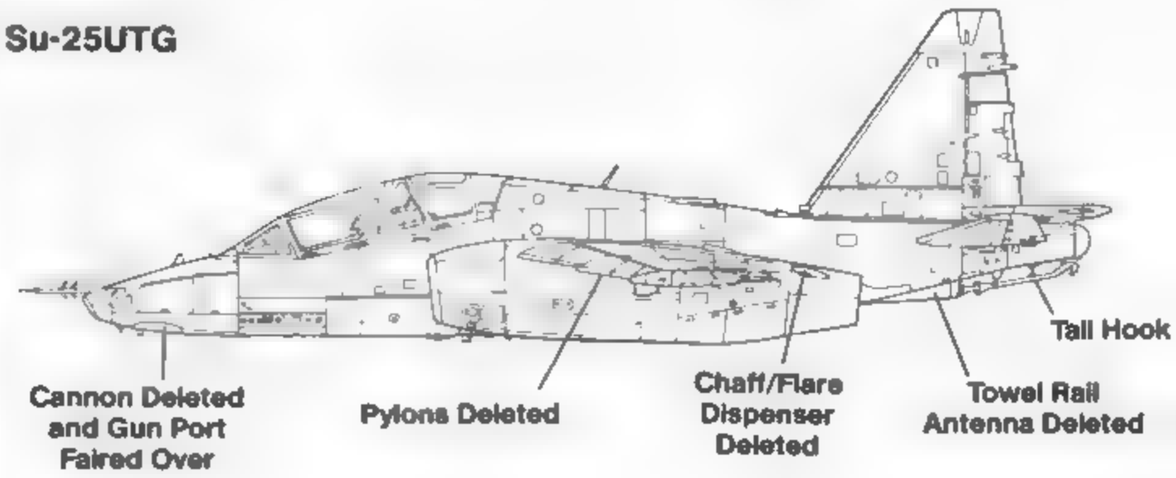
The Su-25UTG prototype on the ramp at Ramenskoye. Blue 08 was the only Su-25 two seat variant to carry the Sukhoi factory badge on the nose; it was not painted on any other training variant. (Sukhoi OKB)

Fuselage Development

Su-25UB



Su-25UTG



The arrestor hook on the Su-25UTG was a heavy unit. The braking parachute was deleted on the naval prototype and the container faired over. The antennas on the post above the arrestor hook are for the Sirena tail warning radar system (Sukhoi OKB)

The Su-25UTG was equipped with K-36 ejection seats in both cockpits. To preserve cockpit pressurization in the event of a canopy failure, the cockpits each had their own system and were separated by an armor glass panel between the cockpits. (Sukhoi OKB)

The Su-25UTG naval trainer prototype, Blue 08, was converted from the Su-25UT advanced trainer. The aircraft rolled out carrying a three tone Blue uppersurface camouflage over Light Blue undersurfaces. The position of the national markings on the wing uppersurface is standard for all Soviet Su-25 variants. (Sukhoi OKB)

The installation of the arrestor hook led directly to the aircraft's designator Su-25UTG since the G stood for *Gak* or Hook. The naval trainer carried no internal armament or underwing pylons (Sukhoi OKB)

Su-25TM Anti-tank Aircraft

T-8M Prototypes

In 1984, the Sukhoi OKB began work on a new variant of the Su-25 which was intended to eliminate most of the shortcomings of the basic Frogfoot A, such as insufficient range, a lack of all weather/night attack systems and the lack of an autopilot. The mission for the new variant was to be all weather anti-tank warfare, with a secondary role of close air support. Since the basic Frogfoot A airframe did not have the internal room needed for increased fuel and avionics, the two seat Su-25UB airframe was chosen for conversion.

The rear cockpit of the Su-25UB was deleted and faired over with the space being used for additional fuel tanks. The nose was stretched to make room for a more sophisticated avionics suite and an entirely new fire control system. The internal AO-17A cannon and its ammunition bay was replaced by an externally mounted GSh-6-30 six barrel 30MM rotary cannon with an ammunition supply of 260 rounds. The gun was mounted under the fuselage, offset to port, and an electronics pod was also mounted under the fuselage, alongside the gun pod. The removal of the internal gun allowed more space for electronics and the fairing over of the cannon port and venting helped clean up the fuselage.

The tail warning radar boom carried at the base of the rudder on the Frogfoot A was deleted and a new antenna was installed on the underside of the fuselage between the rear IFF antenna and the ventral Towel Rail HF antenna.

The new aircraft was given the designation T-8M flew for the first time from Ulan Ude during August of 1984. The three aircraft served as the basis for a new variant, the Su-25TM, and were used to test various components for the new aircraft.

Su-25TM

On the basis of the experience gained with the T-8M prototypes, a batch of ten pre-production aircraft were authorized and built at Ulan Ude. These differed in a number of ways from the T-8Ms. Additionally, the ten aircraft differed from one another in armament and other details, being mainly used for experimental work. These aircraft were considerably upgraded in the avionics suite and had improved countermeasures against surface-to-air missiles, particularly the Stinger shoulder launched missile.

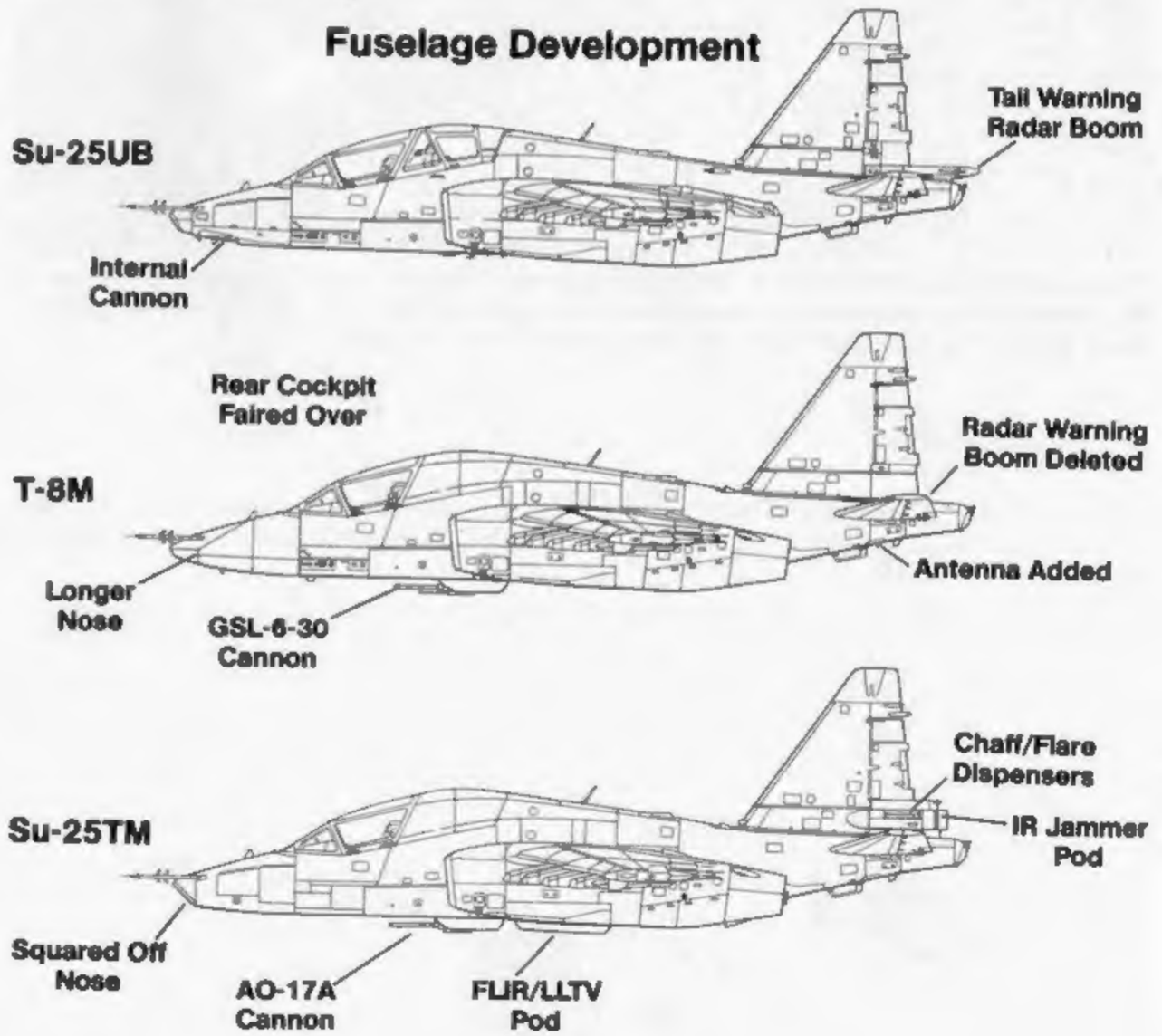
This new variant was given the designation Su-25TM (T, *Tankovyi*, anti-tank). The Su-25TM is capable of engaging enemy tanks, vehicles and other hard targets at night and under all weather conditions. In addition, the weapons system allows the Su-25TM to be used in an anti-ship role and it also has a limited air-to-air capability against helicopters and other low speed aerial targets.

To increase the aircraft's survivability, the center fuselage has been reinforced with additional armor, the engines' infrared signature has been reduced, a 192 cartridge chaff/flare dispenser has been added to the rear fuselage at the base of the vertical fin and there are provisions for the installation of an IR jammer.

The Su-25TM is equipped with an autopilot and a *Voshod* inertial navigation/attack system which works in conjunction with a *Shkval* electro-optical/laser designator/tracker which is housed behind a diamond shaped window in the nose and centerline mounted Low Light Level Television/Forward Looking Infrared (LLTV/FLIR) pod. Other electronic systems include: radar warning receivers, radar self-defense jammers, cockpit CRT displays and a wide field of view Head Up Display (HUD).

Armament of the Su-25TM differs from the T-8M in that the GSh-6-30 was replaced by an AO-17A cannon, mounted externally under the starboard fuselage with a large blast panel fitted to the fuselage ahead of the gun to protect the fuselage from the cannon muzzle blast. Like the earlier Su-25UB, the built in pilot's boarding ladder was deleted on the Su-25TM.

The tail section on the Su-25TM differs considerably from the earlier Su-25 Frogfoot A. The tail warning radar antenna boom was replaced by a large circular electronics pod mounted at the base of the rudder, extending back nearly to the end of the tail cone. There are two radar warning button antennas above this pod. There are additional antennas for the Sirena tail warning system on the vertical fin mounted on the tail position light fairing, a navigational system antenna is installed between the rudders and another antenna is mounted above the tail position light. The large electronics pod is believed to house an IR jammer and has provision for chaff/flare launchers (in addition to those mounted in the tail cone).



The Su-25TM can carry a number of new weapons that cannot be carried by the Frogfoot A. These include the 9M-114 *Skorpion* (NATO name AT-6 Spiral) anti-tank tube launched guided missile and the PTUR *Vikhr* laser guided anti-tank missile. Both missiles are normally carried in four shot pods. The Su-25TM can also carry a ramjet supersonic anti-ship/anti-radiation missile known as the Device 77P. This missile has a range of over sixty-two miles and a speed of over Mach 4. When this weapon is carried, a special pylon/launch rail is fitted in place of the standard weapons pylon.

Several Su-25TMs have been displayed at various air shows. The first was in February of 1992 at Machulishe airfield. This aircraft, Blue 09, was painted in a three tone Gray (Dark, Medium and Light Gray) uppersurface camouflage over Light Gray undersurfaces. The second was at a display held at the Zhukovski Test Center in August of 1992. This aircraft, Blue 10, carried the standard Asian camouflage. Blue 10 also visited Farnbrough, England during July of 1992.

There were a number of differences between the two aircraft. Blue 09 carried a single barrel cannon and no FLIR/LLTV pod, while Blue 10 had a two barrelled AO-17 cannon and a FLIR/LLTV pod on the centerline. Blue 10 also carried a special pylon on the inboard wing station for the Device 77P missile.

Due to economic conditions in the former Soviet Union, the Su-25TM will not go into production unless sufficient export orders are obtained.

The Su-25TM prototype on the ramp at the Zhukovski Flight Test Center while undergoing factory tests. The aircraft is configured with underwing fuel tanks, PTUR *Vikhr* anti-tank missiles, S-25 unguided air-to-ground rockets, B-13L four shot rocket pods and R-60 (AA-8) air-to-air missiles (Sukhoi OKB)

Su-25TK/Su-34

The Su-25TK and Su-34 are export designations for the Su-25TM. This aircraft was introduced to the export market during the Aviation Week displays held in August of 1991 at the Zhukovski Test Center. Shortly after this show, the aircraft, Yellow 25, was flown to the Dubai Air Show in November of 1991.

The Su-25TK/Su-34 will only enter production if export customers can be found for the aircraft. One possible sale, to the United Arab Emirates, was known to be under negotiations during early 1992 and reportedly the sale also included delivery of a number of new technology weapons, such as the *Vikhr* laser guided anti-tank missile. Reportedly, fly-away costs for an Su-25TK is fifteen to twenty million U.S. dollars.

The Su-25TM, Blue 09, on display armed with an AS-14 Kedge on the inboard pylon, PTUR *Vikhr* anti-tank missiles on the next pylon, an AS-10 Karen on pylon three, a four shot B-13L rocket pod for S-13 rockets and a R-60 (AA-8 Aphid) on the outboard pylon. (D. Grinyuk)

The T-8M prototype, Red 02, was converted from an Su-25UB trainer airframe with the rear canopy faired over and the space used for an extra fuel tank. The AO-17A cannon was replaced by an externally mounted GSh-6-30 cannon under the fuselage and the AO-17 gun port was faired over. (Steven Zaloga)

Besides the Su-25TK, the Dubai Air Show also featured other Russian aircraft including the Su-24 Fencer, MiG-31 Foxhound and Su-27 Flanker. (Jim Barr)

For amrament testing the Su-25TM was configured with underwing fuel tanks, PTUR *Vikhr* anti-tank missiles, S-25 unguided air-to-ground rockets, B-13L four shot rocket pods and R-60 (AA-8) AAMs (Sukhoi OKB)

The IR jammer pod at the base of the fin also carries chaff/flare launchers on each side of the pod and radar warning antennas above the pod. (Jim Barr)

The AO-17A 30MM twin barrelled cannon is externally mounted and offset to starboard. (Harry Wisch)

The canopy of the Su-25TM has the rear view mirror mounted on the inside canopy frame while the Su-25 Frogfoot A had the mirror in a fairing on top of the canopy. (Harry Wisch)

The export variant of the Su-25TM is designated the Su-25TK. This Su-25TK, Yellow 25, was displayed at the Dubai Air Show in November 1991. (John Barker via Air Forces Monthly/ David Oliver)

A pair of T-8 preproduction Frogfoot As attack rebel positions in Afghanistan with 330MM S-25 unguided air-to-ground rockets. These were the largest unguided weapons in the Soviet inventory and were first used operationally in Afghanistan.

This late production Su-25 Frogfoot A carries a Light Brown mottle over its standard factory applied camouflage. Red 04 also carries the Excellent Aircraft award on the nose in Red and a Sukhoi factory badge on the fin.